MISSOURI INTEGRATED WATER QUALITY REPORT AND SECTION 303(d) LIST, 2016

Clean Water Act Sections 303(d), 305(b), and 314

Missouri Department of Natural Resources
Water Protection Program

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EXECUTIVE SUMMARY

The Missouri Integrated Water Quality Report was prepared by the Missouri Department of Natural Resources (MDNR, or department) to meet requirements stated in sections 303(d), 305(b), and 314 of the federal Clean Water Act (CWA). Section 303(d) requires states to submit a list of waters not meeting water quality standards. Sections 305(b) requires an assessment of surface water quality and summary of monitoring and pollution control activities. Section 314 requires a status and trends assessment of publicly owned lakes. The primary purpose of this report is to provide the United States Environmental Protection Agency (EPA) and the residents of Missouri with an update on the condition of surface water quality in the state.

Data used in this report were generated through the department's monitoring activities, and the work of other agencies and organizations operating in conjunction with the department or independently. Data were assessed using procedures contained in the department's 2016 Listing Methodology Document (LMD). Monitoring and assessment mainly focused on classified lakes (363,653 acres) and streams (115,772 miles) throughout Missouri.

The 2016 section 303(d) list of impaired waters requiring total maximum daily load studies was approved by the Missouri Clean Water Commission (CWC) on April 6, 2016. This list includes 448 water body-pollutant pairs for both classified and unclassified waters. Common pollutants included bacteria, heavy metals, low dissolved oxygen in water, and mercury in fish tissue. Most common pollutant sources included nonpoint source runoff (agriculture, urban, rural, unspecified nonpoint sources), mining related impacts, atmospheric deposition, and municipal wastewater treatment plants (WWTPs) and other point sources. Twenty-seven water body-pollutant pairs listed in the 2014 Section 303(d) were removed from the 2016 list.

For the 2016 reporting cycle, data were available to assess approximately 24,761 miles of classified streams and 296,962 acres of classified lakes. Of those streams, data indicated 5,307 miles (21 percent) fully supported designated uses that were assessed, while 5,549 miles (22 percent) were found to be impaired for at least one designated use. Major causes for impaired uses included bacteria, low dissolved oxygen, mercury in fish tissue, heavy metals, and limited aquatic macroinvertebrate communities. Major sources of impaired uses included urban and agricultural nonpoint source pollution, municipal point sources, and mining activities. For classified lakes, 189,093 acres (64 percent) fully supported their designated uses that were assessed, while 72,715 acres (24 percent) were impaired for one or more designated uses. Primary causes of impaired uses in lakes included nutrients, chlorophyll-a, and mercury in fish tissue. Major pollutant sources included urban and agricultural nonpoint source pollution, atmospheric deposition, and municipal point sources.

Trophic status was summarized for 214 lakes (267,627 ac.), where 12 lakes (528 ac.) were classified as oligotrophic; 44 lakes (83,572) were mesotrophic; 133 lakes (179,929 ac.) were eutrophic; and, 25 lakes (3,598 ac.) were hypereutrophic. The most notable long-term temporal trends were: (1) decreasing mineral turbidity in lakes of the Glaciated Plains; and (2) increased water clarity in lakes of the Ozark Highlands.

PART A: INTRODUCTION

A.1. Reporting Requirements

This report, *Missouri Integrated Water Quality Report for 2016,* was prepared by the Department to fulfill reporting requirements contained in sections 303(d), 305(b), and 314(a) of the federal CWA. CWA Section 303(d) requires each state to identify waters not meeting established water quality standards, and which also lack an approved Total Maximum Daily Load (TMDL) study or a permit requiring adequate pollution control. Water bodies that are on the 303(d) list are commonly known as "impaired waters." CWA Section 305(b) requires states to submit information pertaining to the overall status of its surface waters, and to provide a description of programs used to monitor and manage water quality and abate any pollution sources. It also provides the opportunity to include a description of groundwater quality in the state, and any related monitoring and protection programs. Under Section 314(a), each state is required to provide an assessment of the water quality of all publicly owned lakes, including a description of their status and trends.

The 2016 Missouri Integrated Report is based on the U.S. Environmental Protection Agency's *Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act* supplemented by memorandums from the Office of Wetlands, Oceans, and Watersheds concerning CWA Sections 303(d), 305(b), and 314 integrated reporting and listing decisions for the 2006, 2008, 2010, 2012 and 2014 reporting cycles. Under the CWA, the department is required to report the quality of the state's waters every two years to the EPA. The EPA compiles all state reports and prepares a summary for the United States Congress on the nation's waters. The report may then be used for rule making, budget appropriations, and program evaluations by federal legislators.

Missouri has a large network of water resources that is a key component to the quality of life in the state. This network of streams, lakes, and wetlands helps support the energy needs of the state, sustains farming and industrial operations, provides habitat to wildlife, and offers a variety of recreational opportunities. Therefore, the efficacy of the department's regulatory and conservation work is imperative. In addition to fulfilling federal reporting requirements, information provided herein is intended to help guide future water resource management efforts in the state.

A.2. Changes from Previous Report

For the 2016 reporting cycle, the main revision to Missouri's water quality standards was the expansion of rivers, streams, lakes and reservoirs that have been assigned designated uses as documented in the Missouri Use Designation Dataset (MUDD). The geospatial framework for development of the MUDD is the 1:100,000 scale National Hydrography Dataset (NHD) created by the United States Geological Survey (USGS). The processes followed for assessing and interpreting water quality data did not change substantially; any changes since the previous reporting cycle include updates to the *Methodology for the Development of the 2016 Section 303(d) List in Missouri* (Accessed from http://dnr.mo.gov/env/wpp/waterquality/303d/303d.htm).

The 2016 LMD describes both the data that may be used for stream and lake assessments, and the assessment methods used to interpret water quality standards for 303(d) and 305(b) reporting. The department is responsible for developing the LMD, which includes methods supported by sound science and advocated by leading experts in a variety of aquatic science fields. In accordance with the Code of State Regulations (CSR) at 10 CSR 20-7.050(4)(A), the 2016 LMD underwent a 100-day public comment period, including time following a Clean Water

Commission hearing. Two public availability meetings were also held within the public comment period. The final 2016 LMD was approved by the CWC on July 9, 2014.

In addition to grammatical corrections, there were a few revisions made between the 2014 and 2016 LMDs. First, the department attempted to clarify the biological assessment process for fish and macroinvertebrates with regard to using the "weight of evidence" approach, handling habitat assessments, and the protocols for using candidate reference streams. Second, the geometric mean rather than the arithmetic mean will be used when evaluating data against sediment toxicity thresholds. For additional information, please see section *C.2.4. Changes to the 2014 Listing Methodology Document.*

A.3. General Overview of the Assessment Approach

The department's Water Protection Program (WPP) administers several water monitoring programs with the goal of generating sufficient data to assess all waters of the state. Monitoring is centered on three general approaches: (1) fixed station monitoring; (2) intensive surveys; and, (3) screening level monitoring. WPP monitoring may also be used to support various department initiatives, and respond to problematic issues that emerge. In addition, the department partners with outside agencies, organizations, and universities to meet its data needs, and it coordinates monitoring among these groups to obtain a comprehensive set of information for assessing state waters. While this approach does not cover all waters of the state, its goal is to provide the greatest scope and quality of coverage possible given the availability of resources. Detailed information regarding departmental and external monitoring programs used to satisfy reporting requirements under the CWA can be found in section *C.1. Monitoring Program*.

Designated uses were assessed whenever sufficient data of reliable quality were available, and previous assessments were updated whenever an adequate amount of new information became available. In some cases, errors that were discovered in previous assessments were corrected. For assessing use attainment, recent data (i.e., less than 7 years old) were preferred. Due to resource limitations, however, there were instances where data older than 10 years were used for assessments if the data were considered representative of present conditions.

In general, surface water assessments in this report were largely based on biological, water quality, physical habitat, fish tissue, and toxicity data collected through 2014. Monitoring predominantly utilized a targeted sampling design that focused on selected waters, and which provided the majority of the data used for water quality-based assessments reported here. To a lesser extent, a probabilistic sampling design was used as a secondary approach for assessing state waters. These data were derived from the Missouri Department of Conservation's (MDC) Rapid Assessment Monitoring (RAM) program and were based on fish community data. The department, through EPA's Section 319 Nonpoint Source Grant Program, provided funding to the University of Missouri-Columbia to support two lake monitoring programs, the Statewide Lakes Assessment Program (SLAP) and the Lakes of Missouri Volunteer Program (LMVP). These data were used to track lake trophic status throughout Missouri and to evaluate water quality trends for lakes with sufficient data.

While surface water assessments were the focus of this report, groundwater information was also included. The department's Public Drinking Water Branch is the lead state agency responsible for monitoring groundwater quality in Missouri. Groundwater monitoring information is provided along with a summary of groundwater contamination and an overview of the programs available to prevent or remediate such problems. For additional information about the Public Drinking Water Branch beyond what is presented in this report, please see the department's website at http://dnr.mo.gov/env/wpp/dw-index.html.

A.4. Organization of Report

Subsequent sections of this report are separated into four general categories. Part B provides background information on streams and lakes within the state, describes the department's water management approach and any programs that protect and improve the quality of surface water, gives an overview of costs and benefits of water management in the state, and provides a summary of important issues affecting water quality and associated management programs. Part C describes ongoing water monitoring programs administered by the department, methodologies used to make assessment determinations for Section 303(d) listings, and major findings resulting from the assessment process. Part D focuses on the status of groundwater resources in the state and related protection and monitoring efforts. Part E discusses department procedures for public participation and stakeholder involvement in the development of the Section 303(d) list. Appendices at the end of this report are reserved for listing waterbody-specific water quality, Section 303(d) prioritization, and other important supporting documents. Appendix B contains the recently approved 2016 Section 303(d) list of impaired waters in Missouri by the Missouri Clean Water Commission.

PART B: BACKGROUND

B.1. Total Surface Waters

Missouri is home to slightly more than 6 million people with approximately one-half of the state's population residing in the metropolitan areas of Kansas City and St. Louis (US Census Bureau 2014). These cities were settled on the Missouri and Mississippi rivers – two of the nation's great rivers – which are essential to the economies of the regions. Beyond the two great rivers, Missouri's landscape contains a network of streams and lakes. These waters are expected to meet the needs of municipal, industrial, and agricultural operations and simultaneously serve as sources of safe drinking water, recreational sites, and wildlife habitats.

Classified streams in Missouri total 115,772 miles and classified lakes cover an area of 363,653 acres (Table 1). Classified streams and lakes include those waters listed in Tables G and H of Missouri's Water Quality Standards at 10 CSR 20-7.031. Classified waters are given priority under the department's current water monitoring program. Unclassified streams contribute another 142,666 miles to Missouri's stream network, while unclassified lakes provide an additional 68,302 acres of surface area. Unclassified streams and lakes refer to waters not listed in Tables G and H, but that are still considered waters of the state. Unclassified waters are afforded protection under Missouri's water quality standards, albeit to a lesser extent than classified waters. In order to be considered a classified wetland under Missouri's Water Quality Standards 10 CSR 20-7.031(1)(F), wetlands must meet criteria established in the *United States Army Corps of Engineers Wetlands Delineation Manual 1987*; however, a defined set of classified wetlands does not exist at this time. Previous work by the department's Division of Geology and Land Survey estimated wetland coverage in the state to be approximately 624,000 acres (Epperson 1992). In comparison, the United States Fish and Wildlife Service's National Inventory of Wetlands currently estimates approximately 1.4 million acres of wetlands exist in Missouri. This estimate is based on palustrine wetland types that include classified and unclassified streams and lakes, or portions of such. Regardless of the source, only estimates of wetland coverage exist for Missouri at this time, and a more precise measurement will not be available until a classified set of wetlands is formally adopted by the state.

Table 1. Overview of surface waters in Missouri.

Topic	Value	Scale	Source
State population (number)	6,063,589	N.A.	US Census Bureau, 2014 estimate
State surface area (sq. miles)	68,742	N.A.	US Census Bureau
River sub-basins (8-digit HUCs)	66	1:24,000	USGS NHD and USDA NRCS WBD
Classified stream (miles)	115,772	1:24,000	WPP MUDD
Perennial (miles)	13,309	1:24,000	WPP MUDD
Intermittent (miles)	102,463	1:24,000	WPP MUDD
Losing streams (miles)	5,267	1:24,000	WPP MUDD
Great Rivers (miles)	1,053	1:24,000	WPP MUDD
Springs (number mapped)	4,487	1:100,000	MGS
Classified lakes (acres)	363,653	1:24,000	WPP MUDD
Unclassified streams (miles)	142,666	1:24,000	USGS NHD
Unclassified lakes (acres)	68,302	1:24,000	USGS NHD
Freshwater wetlands (acres)	624,000	1:24,000	MGS

USGS NHD - United States Geological Survey, National Hydrography Data Set; USDA NRCS WBD - United States Department of Agriculture, National Resources Conservation Service, Watershed Boundary Dataset; WPP MUDD – Water Protection Program, Missouri Use Designation Dataset; MGS – Missouri Geological Survey.

B.2. Overview of Missouri's Waters

Natural lakes in Missouri are limited to oxbow lakes, sinkhole ponds in karst areas, and open water systems in the wetlands of southeastern Missouri (Nigh and Schroeder 2002). Man-made lakes and ponds are common throughout the state. These systems range in size from large reservoirs created for hydroelectric generation and water supply to small ponds used for livestock watering and recreation. The two largest reservoirs in the state are Lake of the Ozarks (59,520 acres) and Harry S. Truman Reservoir (55,600 acres).

The state's stream systems are diverse, and their physical characteristics reflect those of their watersheds. Missouri's streams can be grouped into three aquatic subregions: the Central Plains, the Ozark Plateau, and the Mississippi Alluvial Basin (Figure 1) (Sowa *et al.* 2005). The subregions are distinct with regard to terrain and geology, historical and present day land cover, and stream morphology. Streams in each aquatic subregion generally have similar structural features and functional processes, which result in unique aquatic assemblages and ecological compositions.

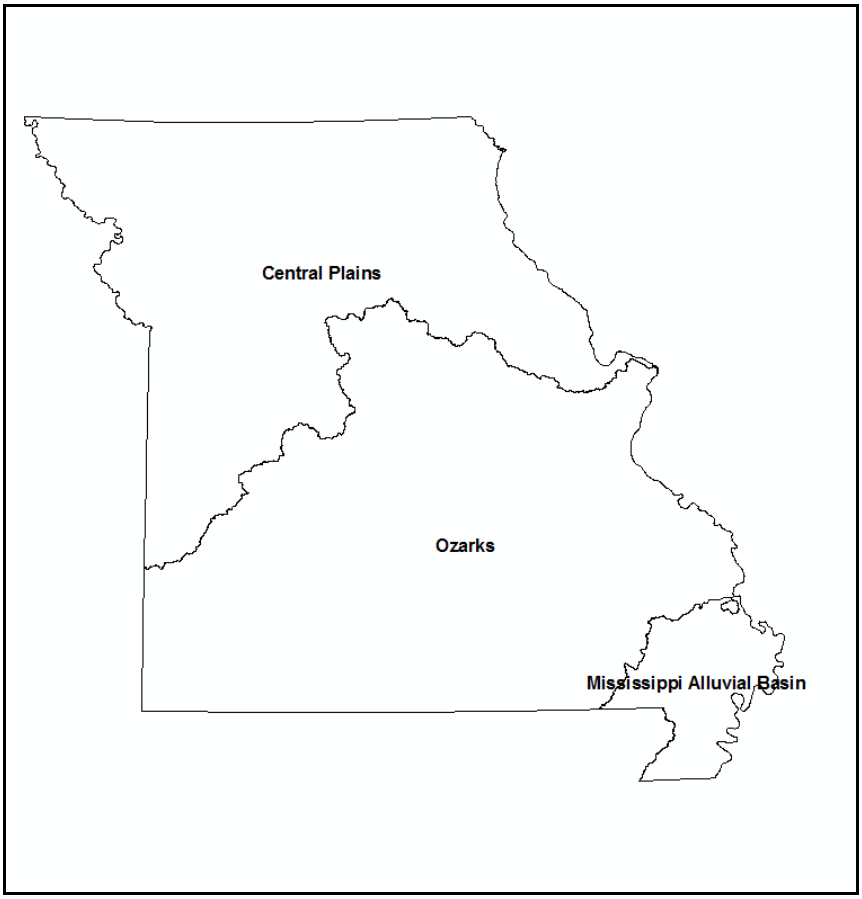

Figure 1. The Aquatic Subregions of Missouri.

Central Plains of Northern and Western Missouri

The Central Plains cover the northern section of Missouri and extend down to the state's west-central region. This western area formerly consisted of broad expanses of prairie, while the northern section contained smaller tracts of prairies separated by forests in valleys and on steeper slopes. The land is underlain by bedrock containing several relatively impermeable shale and clay layers. Today this land is dominated by row crops on the flattest areas with the richest soils, with pasture on irregular surfaces, and forests on some of the roughest tracts. Forests of northern Missouri are more abundant today than they were historically (Nigh and Schroeder 2002).

Surface waters are generally turbid and affected by high rates of sediment deposition. Soil erosion induced sediment deposition degrades aquatic habitat and stresses aquatic life. Up to 8,000 miles of classified streams may be affected by these processes or other types of degradation of aquatic habitat, such as flow modification or channelization that accompany this region's land use.

Rivers and reservoirs used as drinking water supplies experience contamination from herbicides. In the recent past, several reservoirs that served as public drinking water reservoirs exceeded drinking water standards for the herbicide atrazine or health advisory levels for the herbicide cyanazine. Currently, there is just one reservoir listed as impaired for atrazine – Lewistown Lake in Lewis County. Local watershed management programs aimed at reducing herbicide runoff

have been relatively effective. Several other herbicides are occasionally found in drinking water reservoirs, but at concentrations below health advisory levels.

The quality of groundwater in northern and western Missouri is also influenced by the geology of the area. Public water supply sources include reservoirs and wells. The wells obtain water primarily from glacial drift deposits in portions of north-central and western Missouri. Wells in western Missouri, south of Kansas City, obtain water from limestone aquifers, except for the extreme western limits of Missouri near the state border with Kansas. Private water supplies are obtained from glacial drift deposits and from underlying limestone bedrock in portions of northwestern, central, eastern, and northeastern Missouri. However, deep bedrock wells in many north-central and northwestern Missouri locations tap water supplies that are too mineralized for drinking water purposes. It is believed that some private wells in this part of Missouri may exceed the drinking water standard for nitrate, and a very small number may exceed the standard for pesticides. This trend is most frequently caused by localized surface contamination of the wellhead and does not represent widespread contamination of the aquifer. Deeper aquifers are generally protected from surface contamination by impermeable strata.

The Ozarks

The hilly topography of the Ozarks region contains areas with the greatest relief in the state. Pre-settlement vegetation was dominated by forests to the east, woodlands in the central and western Ozarks, and prairies along the outer boundary of the subregion. Currently, the eastern Ozarks is dominated by forest cover whereas the western Ozarks have considerably more land in crops and pasture, with woods concentrated on steeper terrain. The bedrock – consisting of limestone, dolomite, and sandstone – yields groundwater of excellent quality and of a volume generally adequate to supply urban, industrial, and other needs. The soil or subsoil has developed from weathering of bedrock formations and is typically 20 to 80 feet thick. Some areas have extremely thin soils, but in locations where weathering has been extensive, soils may be 100 feet thick or more. The subsoil has moderate to high infiltration rates, which contribute to the recharge of groundwater supplies. Streams are typically entrenched into bedrock and influenced to some degree by groundwater flow from large springs (Nigh and Schroeder 2002). Losing streams, those that lose flow through the stream bed to underground, occur in karst regions of the Ozarks.

Ozark streams are generally clear, with baseflows well sustained by many seeps and springs. Some streams and reservoirs in the Ozarks are becoming nutrient and algae enriched as a result of increasing human population and domestic animal production in their watersheds.

Groundwater contamination risks are moderate to high due to the permeability of the soil and bedrock. A variety of surface activities, including agricultural and suburban-urban stormwater and wastewater disposal, mining, stormwater runoff, lawn care, improper well construction or closure, and individual onsite wastewater disposal practices, pose threats to surface water and groundwater quality. However, overall water quality remains good as a result of efforts to protect vulnerable aquifers in the Ozarks.

Groundwater is relied upon heavily for a drinking water supply in this part of Missouri. Most municipalities in the southern half of the state exclusively use groundwater for their drinking water. The number of private drinking water wells statewide is not known, but is probably between 100,000 and 250,000, mostly south of the Missouri River. One major groundwater concern is the potentially rapid and unfiltered transmission of contaminated surface runoff or leachate (e.g., septic tanks, underground storage tanks, landfills, animal production or processing waste, etc.) through fractures or sinkholes directly into potable aquifers. Properly cased wells

into deep aquifers rarely encounter water quality problems, but shallow or improperly cased wells are at risk.

Mississippi Alluvial Basin

The Mississippi Alluvial Basin consists of flat terrain that at one time was largely covered by seasonal or perennial wetlands called "swamp forests." Nearly all of the historic land cover in this region has been converted to crop production, many streams have been channelized, and the land is drained by hundreds of man-made ditches. The natural hydrography of perennial and seasonal wetlands has been modified here more than anywhere else in Missouri and aquatic habitat degradation is widespread.

Groundwater is abundant due to high infiltration rates on these flat fields. Public water supplies that tap deeper aquifers provide good quality water, but shallow private wells may have nitrates and low levels of pesticides at times. The exceedance frequency of drinking water standards for nitrates and pesticides in private wells would be roughly similar to that in northern Missouri.

Great Rivers

The Great Rivers, the Missouri and Mississippi rivers, are not classified as a subregion of their own, but are unique aquatic ecosystems and represent a significant water resource of Missouri. Approximately 1,053 miles of Great River habitat fall under Missouri's jurisdiction. Great Rivers support a wide array of industrial and commercial needs, numerous recreational opportunities, and are utilized as primary sources of drinking water for many communities. Fish fauna of Great Rivers is comprised of a distinct assemblage of species, some of which occur nowhere else in Missouri (Pflieger 1997).

In northern Missouri, where surface and deep aquifer supplies are unreliable, many towns depend on the alluvial aquifer of nearby rivers. Landfills and industrial land use in Kansas City and St. Louis have historically been located on river floodplains and have caused local contamination of the Mississippi River and Missouri River aquifers near St. Louis and the Missouri River aquifer in Kansas City. While alluvial aquifers of the Great Rivers may yield large quantities of groundwater, pumping induces recharge from the rivers which is a potential source of contamination. Some municipal water supplies have been impacted by groundwater contamination in the past, and thus groundwater from these aquifers requires treatment.

B.3. Water Pollution Control Program

Missouri Surface Water Quality Standards

Authority for enforcing Missouri Clean Water Law and state regulations concerning water pollution resides with the department's WPP. Missouri's approach to water quality management is primarily based on its water quality standards provided in 10 CSR 20-7.031. Under this rule, waters of the state are protected for specific designated uses. Water quality standards are the basis for protecting designated uses, which in Missouri include: (1) drinking water supply; (2) human health protection - fish consumption; (3) whole body contact recreation (e.g., swimming); (4) secondary contact recreation (e.g., fishing and wading); (5,6) aquatic life protection for general warm water and limited warm water fisheries; (7,8) aquatic life protection for cold water and cool water fisheries; (9,10) aquatic life protection for ephemeral and modified aquatic habitats, (11) irrigation; (12) livestock and wildlife watering; and (13) industrial water supply. The department is responsible for developing scientifically-based water quality standards and proposing them to the Missouri CWC for adoption into state regulations. In accordance with the federal CWA, Missouri is required to review and update water quality standards at least once every three years.

To determine if designated uses are being protected, two general modes of water quality standards are used, narrative and numeric criteria. Narrative criteria are essentially protective descriptions that may be measured using numeric values. For example, 10 CSR 20-7.031(4)(D) states that waters shall be free from substances or conditions in sufficient amounts to result in toxicity to human, animal, or aquatic life. Quantitative methodologies then utilize numeric values to determine if a narrative criterion is exceeded and if substance(s) is/are having a toxic effect on human, animal, or aquatic life. In some cases, narrative criteria alone may be used to assess attainment of designated uses. For example, under 10 CSR 20-7.031(4)(A), waters shall be from substances in sufficient amounts to cause the formation of putrescent, unsightly, or harmful bottom deposits to prevent full maintenance of designated uses. Streams with dense mats of floating sewage scum are in violation of this narrative standard. Numeric criteria are essentially water quality limits used to determine if designated uses are attained or not. Quantitative methods always use measured numeric values to examine if the numeric criterion is being upheld.

Additional protection to state waters is provided in the antidegradation component of water quality standards as contained in 10 CSR 20-7.031(3). Missouri's antidegradation policy consists of a three-tiered system. In the first tier, public health, in-stream uses, and a level of water quality necessary to protect in-stream uses shall be maintained and protected. In the second tier, in cases where water quality is better than applicable water quality criteria, the existing quality shall be protected and maintained. Lowering of in-stream water quality is only allowed in such cases when it is determined to be a necessity for important economic and social development. This second tier also contains a set of strict provisions that must be followed for any permitted degradation of state waters. According to the third tier, there shall be no degradation of water quality in outstanding national resource waters or outstanding state resource waters as listed in Tables D and E of 10 CSR 20-7.031.

Point Source Pollution Control

The department, under the State of Missouri's authorization, administers a program equivalent to the National Pollution Discharge Elimination System (NPDES). Under Missouri Clean Water Law, the department issues permits for discrete wastewater discharges (e.g., human wastewater, industrial wastewater, stormwater, confined animal operations, etc.) that flow directly into surface waters. Industrial, municipal, and other facilities are regulated in order to ensure that surface waters receiving effluent from these sources meet water quality standards. Permits include requirements for limitations on specific pollutants (e.g., biochemical oxygen demand, ammonia as nitrogen, chloride, etc.), monitoring and reporting, and the implementation of best management practices (BMPs) as needed. The department requires wastewater facilities to meet certain design specifications, while plant supervisors and other operators are required to be certified at a level that corresponds to the plant's size and complexity. Approximately 1,183 miles of waters assigned specific designated uses are on the 2016 303(d) List as a result of discharges from wastewater treatment facilities. For additional information on the types of regulated discharges and available permits, please see the department's website at http://www.dnr.mo.gov/env/wpp/permits/index.html.

Concentrated animal feeding operations (CAFOs) in Missouri are required to be designed, constructed, operated and maintained as "no discharge" facilities. All wastewater produced is land-applied rather than being treated and released to streams. Permit requirements include development and implementation of a nutrient management plan which contains a strategy for the onsite utilization of BMPs. There are approximately 528 permitted CAFOs in Missouri, and over 95 percent are managed for hog and poultry production. For more information on CAFOs, please see the department's website at http://www.dnr.mo.gov/env/wpp/cafo/.

The department issues land disturbance permits to control stormwater runoff from disturbed sites that comprise an area of one acre or more. Land disturbance permits require the use of BMPs to prevent the migration of silt and sediment into surface waters. A stormwater pollution prevention plan must also be prepared prior to issuance of any permit. Some activities that commonly require land disturbance permits include housing or building construction, road and dam construction, and utility pipelines. For more information on land disturbance permits, please see the department's website at http://www.dnr.mo.gov/env/wpp/stormwater/sw-land-disturb-permits.htm.

The discharge of stormwater runoff transported through Municipal Separate Storm Sewer Systems (MS4s) is another regulated activity. Separate storm sewer systems include any method of conveying stormwater including streets, ditches, swales, or any man-made structure that directs flow. There are 164 identified MS4s in Missouri, and each one is required to develop and implement a stormwater management program to prevent and reduce any contamination of surface waters and prevent illegal discharges. The stormwater management plan includes six minimum control measures: (1) public education and outreach; (2) a process for public involvement and participation; (3) illicit discharge detection and elimination; (4) construction site stormwater runoff control; (5) post-construction stormwater management; and, (6) pollution prevention/good housekeeping for municipal operations. For additional information regarding stormwater regulations, please see the department's website at http://www.dnr.mo.gov/env/wpp/stormwater/index.html.

Nonpoint Source Pollution Control

Nonpoint source (NPS) pollution comes from many diffuse sources and is defined as the transport of natural and man-made pollutants by rainfall or snowmelt, moving over and through the land surface and entering lakes, rivers, streams, wetlands or groundwater. Some common sources of NPS pollution include row crops and agricultural fields, road surfaces and parking lots, septic systems and underground storage tanks. In Missouri, significant contributors of NPS pollution include agricultural land use, urban areas, and abandoned mines. The department takes two general approaches to managing NPS pollution, one that is volunteer-based and offers monetary incentives and grants, and another that is regulation-focused.

Many NPSs may be addressed by the department's NPS Management Program. This program engages concerned citizen organizations, landowners, federal, state and local governments, as well as universities and other stakeholders to implement NPS control practices and monitor improvements to water quality and habitat. One priority of the Nonpoint Source Management Program is to provide citizens the knowledge and ability to improve their common land use practices and to protect water quality. The program's mission is "*to achieve aquatic life usage in 50 percent of nonpoint source impaired waters by 2030.*" NPS projects target numerous runoff pollutants (e.g., sediment, fertilizers, pesticides, and animal waste) and seek to improve aquatic habitat problems by stabilizing stream banks, installing grade control structures, and providing riparian and in-stream cover, among other activities. With the exception of special projects, funded activities are carried out as part of a larger watershed plan to improve specific stream and lake resources. Project funding is provided by the EPA though Section 319(h) of the federal CWA, and supports 60 percent of total project costs. The NPS Program is a key partner of the Natural Resources Conservation Service's (NRCS) Mississippi River Basin Initiative (MRBI) and the recent NRCS-EPA collaborative National Water Quality Initiative. For more information regarding the department's NPS Management Program, please visit the program's website at http://www.dnr.mo.gov/env/wpp/nps/index.html.

The department's Soil and Water Conservation Program (SWCP) provides financial incentives to landowners for implementing conservation practices that help prevent soil erosion and protect water resources. Under this program, 114 district offices serve residents in each county of the state. The SWCP's Agricultural Nonpoint Source Special Area Land Treatment Program allows district staff to direct technical and financial assistance to property owners of agricultural lands identified as contributing sources of water quality impairments. SWCP also administers a cost-share program to help fund up to 75 percent of the estimated cost for certified conservation practices. In addition, SWCP is a contributing partner of the Mississippi River Basin Healthy Watersheds Initiative (MRBI), a 12-state effort addressing nutrient loading in the Mississippi River Basin. SWCP's primary funding source comes from a one-tenth-of-one-percent parks, soils, and water sales tax that is shared with the Division of State Parks. Please visit the SWCP website for more information at http://www.dnr.mo.gov/env/swcp/index.html.

While general NPS pollution is not formally regulated, there are instances of several different types of NPSs falling under a form of water pollution control. As noted earlier, permits are issued to control stormwater runoff from land disturbance activities of an acre or more, as well as for certain industries like biodiesel manufacturers and agrichemical producers. Some additional activities permitted by the state include clay, rock, and mineral mining, abandoned mine land reclamation, land application of human and animal wastewater, and underground petroleum storage. Construction, placement, dredging and filling, or general earth moving within a wetland or waterbody requires a 401 certification from the department and 404 permit from the United States Army Corps of Engineers (USACE) (http://www.dnr.mo.gov/env/wpp/401/). Single family residential wastewater systems, septic systems, which are known nonpoint sources of pollution fall under the jurisdiction and responsibility of the Missouri Department of Health and Senior Services.

Total Maximum Daily Load Program

The Total Maximum Daily Load program provides the framework for identifying the assimilative capacity of a waterbody with regard to a particular pollutant or condition that may impair designated uses. A TMDL is defined as a calculation of the maximum amount of a pollutant that a water body can assimilate while still meeting water quality standards. TMDLs are required when a water body and pollutant pair(s) is listed on the state's approved 303(d) list, i.e., when the designated use of a water is not being protected. The TMDL computes the sum of all loads from point sources, non-point sources, and background conditions. A portion of the load capacity is usually allocated to an explicit margin of safety to account for uncertainties in scientific and technical of water quality in natural systems. Some TMDLs may reserve a portion of the assimilative capacity for anticipated growth in the watershed. Recently, the department began developing implementation plans to accompany TMDLs; these plans will serve as guidance to watershed managers and landowners to protect water quality through the application of demonstrated best management practices.

Since 1999, the department and EPA have developed 122 TMDL documents and permits in lieu of TMDLs. In some cases, TMDL documents contain multiple TMDLs to address each water body and pollutant pair. There are currently 21 TMDLs that are under various stages of development. Additional information regarding the TMDL program can be found at http://www.dnr.mo.gov/env/wpp/tmdl/.

Watershed Based Programs

In the fall of 2011, the department announced a new approach for managing waters of the state. The Our Missouri Waters Initiative (OMWI) program focuses on developing local participation at the watershed level in order to address unique challenges facing streams and lakes in Missouri.

The program seeks to bring together key stakeholders in each watershed, state and federal agencies, and harness as much technical and financial support as necessary to improve each watershed. The department selected three pilot watersheds to concentrate on for the initiative's first phase, the Spring River, Big River, and Lower Grand River watersheds. As of October 2013, each watershed had held a summit for discussing prevailing issues and best strategies for protecting surface and groundwater resources. By the end of 2016, the department hopes to establish a Watershed Advisory Committee in more than 40 of the 66 8-digit Hydrologic Unit Code (or HUC) watersheds in the state. Additional information regarding OMWI may be found at http://dnr.mo.gov/omw/.

In 2012, the department adopted a watershed-based management framework for managing the state's water resources and integrating activities under OMWI (MDNR 2012). Managing waters using a watershed approach requires the department to synchronize activities occurring in a watershed, including: monitoring, assessment, planning, permitting, modeling, conservation and BMPs, and other department activities. The watershed-based framework overall is a strategy for streamlining and coordinating watershed activities and addressing aquatic resource issues more effectively.

Within the watershed-based management framework, the 66 HUCs are divided into five groups with each group having a specific five-year planning cycle. On average, there are 13 HUCs per group, each with an average of 275 site-specific permits (discharge >50,000 gpd) that will be synchronized for renewal every five years. The planning cycle coincides with CWA Section 402 NPDES permitting requirements and better equips the WPP, and other programs and agencies, to plan and coordinate any activities taking place within each sub-basin. Permit synchronization first began in 2012, but due to permit density across management jurisdictions, synchronization for some permits may not be completed until 2022.

B.4. Cost/Benefit Assessment

Section 305(b) requires the state to report an estimate of economic and social costs and benefits required to realize objectives of the CWA. Cost information pertaining to water quality improvement and protection efforts is difficult to calculate exactly, but can be estimated to some degree. While the department tracks its own programmatic costs, those representatives of municipal, private, and industrial treatment facility operations, and in some cases, the implementation of BMPs, are typically not readily available. Economic benefits, in monetary terms, resulting from water protection efforts are even more difficult to calculate. An overview of the amount of funding the department spends on various aspects of water pollution control and prevention is provided in the following paragraphs.

The department spends an average of $1.2 million on the USGS ambient water quality monitoring network each year. Annual costs for permit issuance averaged approximately $2.96 million for fiscal years 2014 and 2015. On average, approximately $7.6 million is spent each year for other facets of water pollution control and administrative support.

Another significant expense includes grants aimed at improving water quality. The department awards funding provided by the EPA under Section 319 of the CWA for projects that address NPSs of pollution, and approximately $3.9 and $3.8 million was spent on NPS projects in state fiscal years (SFYs) 2014 and 2015, respectively. Approximately $200,000 is awarded annually for planning such projects.

Through the department's SWCP, an average of $24.1 million each year is distributed directly to landowners to address agricultural NPS pollution and to conserve and protect the quality of water

resources in agricultural landscapes. Over FFYs 2014 to 2015, a total of $48.3 million was spent on SWCP conservation practices aimed at reducing soil runoff from farmland. Conservation practices have focused on managing animal waste, livestock grazing, irrigation, nutrients and pests, protecting sensitive areas and reducing erosion. Over the life of these conservation practices (i.e. generally 10 years), it's estimated that 4.3 million tons of soil will be protected.

Missouri's Clean Water State Revolving Fund (CWSRF) makes low interest loans available to eligible recipients for designing and constructing publicly-owned wastewater systems and other eligible projects including, but not limited to, stormwater infrastructure, non-point source projects, and water conservation or reuse. During the 2013 reporting period, six direct loans and one grant were awarded for a total of $75,669,897 in CWSRF binding commitments. During the 2014 reporting period, six direct loans, three grants, and one animal waste treatment loan were awarded for a total of $137,825,840 in CWSRF binding commitments. Funding for the CWSRF is provided by the EPA with matching funds from the state of Missouri. As of September 30, 2014, the SRF's cumulative binding commitments have totaled $2,462,025,389, resulting in estimated interest savings for Missouri communities of $819,937,662 as compared to conventional loans.

The department's Public Drinking Water Branch operates a Source Water Protection Program (SWPP) that is designed to keep drinking water safe for Missouri's residents. The SWPP operates under a voluntary basis to provide public water suppliers with opportunities to protect drinking water that may be threatened by potential contaminants such as pesticides, other hazardous chemicals, stormwater runoff, and waste disposal sites and septic tanks. Funding activities primarily include wellhead protection and capacity development. Costs associated with implementing SWPP activities are generally funded by drinking water SRF set aside monies.

Looking ahead, the Natural Resource Damages (NRD) program, based primarily upon authority vested in the federal "Superfund" law, is responsible for assessing injuries to and restoring natural resources that have been impacted by environmental hazards. The department's NRD staff, together with federal trustees such as the United States Fish and Wildlife Service (USFWS) and United States Forest Service (USFS), has reached settlements totaling approximately $70 million to restore impacted natural resources and the services they provide. Natural resource damage assessment and restoration settlements were largely the result of impacts from heavy metal mining in southeast and southwest Missouri. Two regional restoration plans, which guide restoration activities, have been developed to date, including one for the Southeast Missouri Ozarks Lead Mining District and another for the Missouri portion of the Tri-State Mining District located on the Springfield Plateau. The trustees are actively funding restoration projects in these regions to ameliorate the negative impacts of heavy metals on natural resources.

To maximize efficiency, the department routinely coordinates its monitoring activities to avoid overlap with other agencies and to provide and receive interagency input on monitoring study design. Program coordination between Missouri and Arkansas is one specific example. Both states entered into a Memorandum of Agreement on November 2008 with the goal of enhancing and promoting cooperation among resource management agencies to address water quality and quantity issues involving surface and ground water resources shared between the two states.

Water quality is an essential prerequisite for quality living in Missouri. The economic benefits of clean water, while difficult to quantify, include: opportunities for water-based recreation such as canoeing, swimming and quality sport fishing; the ability to safely incorporate fish into one's diet; restored stream environments; aquatic ecosystems with abundant and diverse animal and plant life; and access to quality drinking water with reduced financial burden on those that treat

water. The department's water protection efforts yield economic benefits far-reaching in scope, helping to insure a prosperous outlook for future generations of Missourians.

B.5. Special State Concerns and Recommendations

Missouri has accomplished significant advances in environmental quality due to its water protection programs. Municipal and industrial wastewater discharged to state waters is not permitted without consideration given to the potential impacts to receiving waters. Improved forestry and agriculture practices have reduced polluted runoff. The same conservation practices have helped preserve farmland and enhance wildlife habitat. While Missouri waters are certainly cleaner today than 30 or 40 years ago, substantial threats remain. Current major environmental concerns may be divided into categories as described in the following paragraphs.

Agricultural and Urban Land Use as Nonpoint Sources of Pollution

Managing agricultural and urban runoff is an ongoing challenge in Missouri; both sources have substantial influence on the condition of water quality. Cropland runoff may contain large amounts of sediment, nutrients, and pesticides. Pollutant loads from urban runoff include sediment from new development and construction; oil, grease, and other chemicals from automobiles; nutrients and pesticides from commercial and residential lawn management; grass clippings and brush disposal into streams; road salts, and heavy metals. Impervious surfaces such as roadways and roof tops increase water volumes in streams during storm events and lower baseflows during dry periods. This hydrological pattern frequently results in eroded stream banks, widened channels, and impaired habitat. Moreover, impervious surfaces are easily heated by the sun which in turn warms surface runoff and ultimately causes stream temperatures to increase. Changes in water quality and habitat conditions that generally accompany urban and agricultural runoff impair aquatic life and diminish the value of other designated uses.

Department programs that are both regulatory and voluntary have proven effective for managing runoff, but such programs are not available to cover all runoff problems occurring across the state. Additional resources and external support are needed to eliminate the threat of NPS runoff.

Municipal and Industrial Sources

Wastewater treatment facilities and other point source dischargers have a significant impact on water quality. Point sources are subject to NPDES permit requirements; however, pollution incidents still happen occasionally. Failing treatment systems, bypasses, accidental spills, or illicit waste disposal are some types of violations that can occur. Discharges of inorganic nutrients may promote blooms of algal growth in receiving waters. Raw or partially treated sludge releases will degrade aquatic communities as organic matter decomposes and dissolved oxygen removed from the water. Other toxic substances can have more direct effects on aquatic life.

Pharmaceutical and Personal Care Products (PPCPs) include any product used by individuals for personal health or cosmetic reasons, or those used by agribusiness to enhance the growth or health of livestock. Some examples of PPCPs include endocrine disrupting sex hormones, antibiotics, steroids, antidepressants, and various prescription and over-the-counter drugs. Treatment facilities are not equipped to eliminate PPCPs from wastewater as these substances pass through on their way to receiving streams and lakes. While little is known about the impacts of PPCPs on human health, aquatic organisms at any stage in development may be affected. An example of the effect of PPCPs on aquatic biota is the feminization (disruption of normal gonad development and function) of male fish as a result of estrogens being released into the water.

The department has worked with numerous entities to upgrade wastewater treatment facilities in order to meet water quality standards. While the majority of treatment facilities are in compliance, additional facility upgrades are anticipated. The objective of these upgrades is to further alleviate water quality degradation.

Abandoned Mines

Current mining operations have caused significant changes to water quality. Heavy metals such as lead and zinc may enter streams from smelters, mills, mine water, and tailings ponds. However, abandoned lead-zinc mines and their tailings continue to impact waters after mining activity has ceased for decades. Mines that have been left exposed to the elements may pollute waters via stormwater, erosion, and fugitive dust. Through these same pathways, mines that were properly shutdown after operations, but then reclaimed for another land use, have also polluted the environment.

Missouri's Superfund Program is addressing some of these concerns, but despite such efforts, long-term impacts are expected to remain until additional resources are made available. Monitoring will need to target abandoned mines that are suspected of contributing heavy metals to streams. Similarly, reclaimed mines may need to be inspected from time to time to ensure post closure actions have been maintained. Although new mineral extraction operations would be managed under state permits, areas of the state that are sensitive to disruption are being investigated for mining potential.

Concentrated Animal Feeding Operations

As of December 2015, there were 528 Class I CAFOs located in Missouri. These include operations containing at least 1,000 beef cattle, 2,500 large swine, or 125,000 broiler chickens. Facilities that generate large amounts of animal waste and manure have the potential to cause serious water pollution problems. Commercial application of manure on fields is also a growing trend within large-scale agriculture operations. The department is concerned by the cumulative impacts of numerous small animal production facilities as well. However, it is no longer issuing letters of approval for smaller facilities, meaning they will be largely unregulated.

Missouri's CAFO laws and regulations are designed to minimize any threats of water pollution and ensure long-term protection for the environment. A series of permits are required per CAFO, including a construction permit, a land disturbance permit, and an operating permit. Additionally, issued permits require a nutrient management plan and the implementation of certain management practices for the land application of animal waste.

Mercury in Fish Tissue

Mercury levels in fish continue to impair fish consumption in Missouri waters. For 2016, totals of 740 stream miles and 28,071 lake acres were listed as impaired for mercury in fish tissue. Waters that have been monitored for long periods have shown that mercury levels in fish tissue have remained relatively stable over the years. Without adequate air pollution control, it is anticipated that future monitoring will detect additional waterbodies with elevated levels of mercury in fish tissue.

The Missouri Department of Health and Senior Services (MDHSS) issues an annual health advisory and guide for safely eating fish. Due to mercury contamination, the MDHSS has issued a statewide advisory for a sensitive population that includes children younger than 13, pregnant women, women of childbearing age and nursing mothers. This group has been advised to limit consumption of walleye, largemouth bass, spotted bass and smallmouth bass greater than 12 inches in length to one meal per month, and all other sport fish to one meal per week. The

advisory also includes a limit of one meal per month for white bass greater than 15 inches in Clearwater Lake only. Additional advisories for all consumers due to other contaminants may be found at http://health.mo.gov/living/environment/fishadvisory/. In most instances and for most people, the health benefits of eating fish outweigh the potential risks from contaminants. The department plans to continue monitoring for mercury levels in fish.

Eutrophication

Eutrophication of state waters, particularly the recreationally important large reservoirs, is an ongoing concern. Heavy residential development around portions of these reservoirs can threaten water quality in coves and shoreline areas. The large size of these reservoirs and rugged local topography make the construction of centralized collection and treatment systems for wastewater difficult. Without proper maintenance of lakeside septic systems, nutrient-enriched water can find its way to the lake.

Missouri's water quality standards do not include statewide nutrient criteria, but site-specific criteria have been assigned to a limited set of lakes. Moreover, the imposition of limits on most wastewater discharges to Table Rock Lake has reduced phosphorus levels in the James River arm of that lake. The department continues to track lake nutrient conditions and offers various programs and grants to help address any issues and concerns. For example, the department awarded $1,000,000 to the Upper White River Basin Foundation for the purpose of assisting homeowners with the cost of replacing failing septic systems through a combination of grants and loans through the WPP's Financial Assistance Center.

Groundwater Protection

Additional groundwater protection measures are needed. Missouri has programs in place to register and inspect underground storage tanks and oversee the cleanup of leaking underground storage tank sites. Additional programs address wellhead protection, the sealing of abandoned wells, and the closing of hazardous waste sites. A complete groundwater protection program would also include a groundwater monitoring network accompanied by educational programs for those involved in the application of farm chemicals, transport of hazardous materials, and the general public. Additional information may be found at http://dnr.mo.gov/env/hwp/.

Additional Concerns

Beyond the threats and concerns mentioned above, others remain. Fish and macroinvertebrate data from across the state indicate biological communities are impacted by degraded aquatic habitat. Physical alterations of the channel, alterations in stream flow patterns, removal of much or all of the riparian zone, and upland land use changes in the watershed are all significant contributors to this problem. Stream channelization is prevalent in the northern and western Central Plains as well as the Mississippi Alluvial Basin in the southeastern corner of the state. Large-scale channelization projects no longer occur, but smaller projects are still carried out to facilitate urban and residential development. Stream road crossings are an additional source of habitat degradation. Low-water crossings and improperly placed and/or sized culverts, which are frequently encountered across Missouri, create upstream barriers to fish passage and are primary points of habitat fragmentation.

Aquatic nuisance species pose a significant threat to the aquatic resources and economy of Missouri. Several invasive species are already present in some waters of Missouri including the zebra mussel (*Dreissena polymorpha*), Eurasian water milfoil (*Myriophyllum spicatum*), and silver carp (*Hypothalmichthys molitrix*). Algae commonly known as "rock snot" (*Didymosphenia geminate*) and hydrilla (*Hydrilla verticillata*) have been found in neighboring states and are

continuing threats due to human dispersal. MDC developed an Aquatic Nuisance Species Management Plan in February 2007.

Climate change presents additional challenges to the state's aquatic resources. In the Midwest, coldwater fish species are projected to be replaced by cool water species (Karl *et al.* 2009). While precipitation is projected to increase in winter and spring with intense events occurring more frequently throughout the year, warmer temperatures during summer may increase the likelihood of drought (Karl *et al.* 2009). Resulting changes in stream flow would be more likely to have a negative impact on aquatic habitats and residing organisms. According to Missouri's Forest Resource Assessment and Strategy (Raeker *et al.* 2010), riparian forests could become more important than ever for protecting stream banks and providing filtering functions under a significantly wetter climate. Previously mentioned aquatic invasive species are projected to benefit under a changing climate as they tend to thrive under a wide range of environmental conditions compared to a narrower range tolerated by native species (Karl *et al.* 2009).

PART C: SURFACE WATER MONITORING AND ASSESSMENT

C.1. Monitoring Program

The overall goal of Missouri's water quality monitoring program is to provide sufficient data to allow for a water quality assessment of all waters of the state. This goal is achieved by meeting six specific objectives: (1) characterizing background or reference water quality conditions; (2) better understanding daily, flow event and seasonal water quality variations and their underlying processes; (3) characterizing aquatic biological communities and habitats and distinguishing differences between the impacts of water chemistry and habitat quality; (4) assessing time trends in water quality; (5) characterizing local and regional impacts of point and NPS pollution on water quality, which includes compliance monitoring and development of water quality based permits and TMDL studies; and, (6) supporting development of strategies to return impaired waters to compliance with water quality standards.

Monitoring includes four strategic approaches to meet the six specific objectives mentioned above: (1) fixed station monitoring; (2) intensive and special surveys; (3) screening level monitoring; and (4) probability-based surveys. Missouri's "Surface Water Monitoring Strategy" (MDNR 2013) provides an in-depth discussion of the entire water quality monitoring program and strategy. All monitoring is conducted under approved Quality Assurance Project Plans with the department's Environmental Services Program (ESP) laboratory. The department's quality assurance management program was previously approved by EPA.

Fixed Station Monitoring

The fixed station monitoring network is designed to obtain water chemistry, sediment, fish tissue, and biological monitoring sites equitably among major physiographic and land use divisions in the state. Selected sites must meet one of the following two criteria: (1) the site is believed to have water quality representative of many neighboring streams of similar size due to similarity in watershed geology, hydrology and land use, and the absence of any impact from a local point or discrete nonpoint water pollution source, or (2) the site is downstream of a significant point source or localized nonpoint source area. There are five subprogram areas that make up the fixed station network.

1. The department provides funding for an ambient stream network that includes nearly 70 sites monitored between six to 12 times per year by the USGS for a wide variety of physical, chemical and bacteriological constituents, and six of these sites are also

sampled at less frequent intervals for a range of pesticides. Two sites on the Missouri River use sondes to collect continuous water quality data from spring through fall.

2. DNR chemical monitoring at approximately 58 sites two to 24 times per year for nutrients, major ions, flow, temperature, pH, dissolved oxygen and specific conductance.

3. Lake monitoring consists of two programs, the Statewide Lake Assessment Program and the Lakes of Missouri Volunteer Program. SLAP samples an average of 76 lakes four times each summer for nutrients, chlorophyll, volatile and nonvolatile solids, and secchi disc depth. LMVP volunteers sample approximately 65 – 70 lakes six to eight times per year for total nitrogen, total phosphorus, chlorophyll a, and secchi disc depth. Multiple sites are sampled on some larger reservoirs. For additional information regarding LMVP, please see this program's website at http://www.lmvp.org/.

4. Fish tissue monitoring is conducted to assess the health of aquatic biota as well as the human health risk associated with consuming fish. Fourteen fixed sites are monitored once every two years and samples analyzed by EPA for mercury, chlordane, and Polychlorinated Biphenyls (PCBs). Whole fish composite samples of either common carp or redhorse sucker are analyzed for metals, mercury, cadmium, selenium, several pesticides, and PCBs. In the future, EPA plans to analyze such samples for only mercury; therefore, the department is currently seeking another means to maintain PCB analyses.

   Under a joint effort between the department and MDC, samples of bottom feeding and piscivorous fish at approximately 28 discretionary sites are collected annually. Bottom feeding fish include common carp and sucker species. Piscivorous fish sampled are preferably black bass species, but alternatively include walleye, sauger, northern pike, trout, flathead catfish, and/or blue catfish. Tissue plug samples are collected from bass species and analyzed for mercury only. Fillet samples (skin off) are collected from the remainder of bottom and non-bottom feeding species. Fillet samples are analyzed for metals, including mercury, cadmium, and selenium; additionally, fillet samples from bottom feeding species are analyzed for a suite of organic compounds, including several pesticides and PCBs.

   Outside of department-based sampling, MDC monitors another 20-40 sites each year that are considered popular sport fisheries. Fish tissue is analyzed for pesticides, PCBs, mercury and other metals. This data is submitted to the department and is used to assess the human health/fish consumption beneficial use for the waterbody.

5. Routine monitoring is conducted at 10-15 discretionary sites annually to test for sediment contamination. Sediment samples are analyzed for a suite of heavy metals that individually or synergistically are known to be lethal or detrimental to fish, mussels, and other macroinvertebrates.

In addition to sampling activities noted above, the department's Division of State Parks conducts routine bacterial monitoring of swimming beaches during the recreational season.

Intensive and Special Studies

Intensive and special studies typically involve frequent monitoring of several sites in a small geographic area. These studies are driven by the need for site-specific water quality information. Findings resulting from intensive and special studies may be used to develop water quality based

NPDES permit limits, assist with compliance and enforcement activities, or guide resource management. The department currently conducts several types of intensive and special studies.

- Wasteload Allocation Studies – Assess receiving waters of wastewater treatment facilities to judge compliance with in-stream water quality standards and/or be used to develop water quality based permit limits. Approximately ten wasteload allocation studies are completed annually.

- Toxics Monitoring – Assess receiving waters of coal mining and processing stations, metal mining operations, various industrial and municipal facilities and CAFOs. The need for this type of monitoring varies greatly from year to year, from zero to 30 sites. Sampling frequency depends on the intended use of data.

- Aquatic Invertebrate Biomonitoring – Macroinvertebrate communities are surveyed to evaluate concerns with either point source discharges, discrete NPS areas such as active or abandoned mining sites, or watershed wide NPS problems. Reference sites are sampled periodically as controls to which targeted sites may be compared. Approximately 45-50 sites are sampled each year. Additionally, the department contracted with the USGS in 2001 to conduct a study of aquatic invertebrate communities on the Missouri River. The study, *Validation of Aquatic Macroinvertebrate Community Endpoints for Assessment of Biological Condition in the Lower Missouri River*, was published in 2005. The department sees this work as the first of several steps by which it will promote a better understanding of fish and invertebrate communities of large rivers, and ultimately the development of biological criteria for the Missouri and Mississippi rivers.

- Dissolved Oxygen Studies – Continuous monitors (data sondes) are deployed where low dissolved oxygen levels are suspected. Sampling is carried out below selected hydropower dams with past low dissolved oxygen problems and in other areas where noncompliant discharges are suspected.

- Stream Modeling Studies – Physical and chemical characteristics of designated streams are surveyed. Measurements include the following parameters: channel width and depth, water velocity, water temperature, pH, dissolved oxygen, and chemical biological oxygen demand, and ammonia. Such studies are often carried out for wasteload allocation purposes. Sampling occurs as needed, but is usually limited to about two streams each year.

- Contract Studies – The department typically has several active contracts for water quality monitoring at any given time. Most contracts support CWA Section 319 funded watershed projects, but past contractors have completed Use Attainability Analyses (UAAs) as well as simple monitoring projects, specifically in cases where work entailed highly specialized skills and equipment, or when costs or manpower limitations made it practical.

Screening Level Monitoring

Screening level monitoring involves two separate strategies, low flow surveys and volunteer-based water quality monitoring. Both strategies integrate rapid stream assessment protocols that rely on qualitative sampling of stream biota and visual evidence. Additional water chemistry sampling may occur as a result of inspections and complaint investigations.

Low flow surveys are conducted to assess stream condition potentially influenced by wastewater treatment facilities, mining activities, or landfills. These surveys are a rapid and inexpensive

method of screening large numbers of streams for obvious water quality problems and determining where more intensive monitoring is needed. Generally, around 100 sites are screened each year.

The Volunteer Water Quality Monitoring (VWQM) Program is a cooperative project between the department, MDC, and the Conservation Federation of Missouri. This program is a subset of the Missouri Stream Team Program. Since its inception in 1993, 9,600 citizens have attended 657 water quality monitoring workshops held by program staff across the state. This has resulted in the submission of more than 29,285 separate data sheets at 4,798 Missouri stream sites. Volunteers spent a total of more than 449,186 hours in this endeavor, worth an approximate $8,983,732 in added value to the state.

In SFY 2014, 202 new stream teams formed and in 2013 there were 168 new teams added. The total number of stream teams has now reached 5,203. In 2014, a total of 268 citizens attended the introductory class, while 225 attended the same workshop in 2015. After the Introductory workshop, many proceeded on to at least one workshop for higher level training. In SFY 2014, 76 citizens attended the Level 1 workshop, and in SFY 2013 there were another 92 citizens. The number of volunteers that attended Level 2 workshops in SFY 2012 and 2013 were 38 and 44, respectively. In 2014, two Level 3 audits were held and five Cooperative Stream Investigation (CSI) advanced monitoring projects were initiated involving six volunteers. For SFY 2016, it is projected that six CSI and advanced monitoring projects will take place involving 18 volunteers. Each level of training is a prerequisite for the next higher level, as is acceptable data submission. Levels 2, 3, 4, and CSI are accompanied by increasingly higher quality assurance and quality control stringency. Data submitted by volunteers of Level 2 or above may be used by the department to establish baselines of water quality condition for particular streams, or to point out potential problems that are in need of further investigation. Level 2 and higher volunteer monitors are required to return for a validation workshop at least every three years in order to ensure their equipment and methods are up to date, and the data they are gathering has a high level of quality assurance. A total of 115 volunteers returned for validation training as of July 2015. A total of 61 volunteers have received CSI training as of August 2015. In SFYs 2014 and 2015, volunteers submitted 1,906 sets of macroinvertebrate data, 1,632 sets of water chemistry data, 523 sets of visual survey data, 971 sets of stream discharge data, and 174 site selection data sheets. Wastewater, CAFO and drinking water operators have also attended workshops in order to receive operator certification credits. To date, 276 operators have attended stream team trainings.

Level 2 volunteer data, or higher, is screened annually for physical, chemical, and biological parameters. If adequate data indicate water quality concern or a potential issue, then follow up monitoring by the department is scheduled. CSI level volunteers may be directly utilized for assisting in departmental studies (e.g., watershed planning, TMDL implementation plans, etc.). In order for higher level data to be utilized by the department for 303(d) and 305(b) purposes, there must have been at least five chemical monitoring visits and/or three biological monitoring visits within a four-year period. For additional information regarding the department's VWQM program, please visit the following website http://www.dnr.mo.gov/env/wpp/VWQM.htm.

Probability-based Sampling

The department's probability-based sampling is derived from a partnership with the MDC that is formalized in a signed Memorandum of Understanding (MOU). With this MOU, the department and MDC share various resource management responsibilities through specific programs. It is under MDC's RAM program that the department's probabilistic-based sampling is carried out

(Combes [MDC], pers. comm.). This sampling effort supports MDC and department trend monitoring as well as CWA Section 305(b) and 303(d) reporting requirements.

MDC's RAM program monitors approximately 70 stream sites annually from third to fifth order streams. From 2004 to 2008, up to 40 sites were randomly sampled from ecological drainage units on a rotating basis. However, in 2010 sampling focused on aquatic sub-regions rather than ecological drainage units. To ensure all regions of the state are monitored effectively, sampling is conducted on a five-year cycle, with two years spent monitoring streams in the Central Plains subregion, two years in the Ozark subregion, and one year in the Mississippi Alluvial Basin subregion (see Figure 1). The first statewide cycle was completed in 2014, with 173 random sites and 24 reference sites sampled. In 2014, the RAM program switched focus to sampling sites for research related to headwater streams and instream flow issues, but will resume probability-based sampling when those research needs are met. The RAM program assesses stream habitat, aquatic invertebrate and fish communities, and water quality at each stream site. Metrics for assessing the biological integrity of fish communities have thus far only been developed for the Ozark and Ozark border streams (Doisy *et al.* 2008). MDC may also report potentially impaired sites to the department for additional monitoring. The department is looking to develop a probability-based survey program that may include low flow surveys and fish tissue contaminants in order to support statewide waterbody assessments.

Monitoring Program Evaluation

The above components to the department's water quality monitoring program describe the approach for a comprehensive assessment of state waters. Additional elements of the program such as core and supplemental indicators, quality assurance, data management, data analysis and assessment, reporting, and general support and infrastructure are discussed in Missouri's "Surface Water Monitoring Strategy" (MDNR 2015).

Monitoring has generally addressed critical point source assessments as needed and has adequately characterized regional water quality unimpaired by point source discharges. However, the state's information needs have considerably increased with the advent of large CAFOs, concern over eutrophication of Missouri's lakes and reservoirs, and continuing and expanding urban development, as well as other issues. Only 21.4 percent of Missouri's classified stream miles were assessed for this report. Of this total, 5.44 percent of Missouri's classified stream miles were considered to be monitored (i.e., recent [2009-2014] data were available), whereas 15.95 percent were evaluated despite the lack of recent data. Thus, 78.6 percent of the state's classified stream miles not assessed. Information gaps and data needs are highlighted in Missouri's "Surface Water Monitoring Strategy" document. Among the major monitoring needs identified in this strategy are: (1) the ecological characterization of the Mississippi, Missouri, and other large rivers; (2) the inventory, monitoring, and assessment of the state's wetlands; (3) bacterial monitoring of large reservoirs and biological criteria development for small reservoirs and lakes; (4) screening level surveys for intermittent streams; and (5) additional chemical monitoring of small wadeable streams.

Data Acquisition and Information Sharing

The department retrieves a large amount of raw data from the USGS and other state, federal, and municipal sources. These data, along with the department's, are imported to and maintained in the department's Water Quality Assessment (WQA) database. Data include information pertaining on water chemistry, bacterial concentrations, sediment toxicity, fish tissue contaminants, and fish and invertebrate communities. The WQA database is available to the public online at http://www.dnr.mo.gov/mocwis_public/wqa/waterbodySearch.do.

Missouri uses the internet-based WQA system for tracking and reporting water body use attainment information. The stream and lake network of the state, water quality standards information, and locations of permitted wastewater discharges and other potential pollutant sources can all be viewed within a Geographic Information System (GIS) (ArcView) environment. The department has developed an interactive map viewer and query tool for public use that displays a range of geographic information and is available at www.dnr.mo.gov/internetmapviewer/.

ESP has developed a bioassessment database that provides access to raw data and summarized statistics for all macroinvertebrate sampling it has completed. This database is typically updated following each season of sampling and the most recent version is available to the public online at http://dnr.mo.gov/env/esp/Bioassessment/index.html.

The department has a variety of additional information regarding water quality and conservation programs in the state on its website at www.dnr.mo.gov/water.htm. Some of the available information includes current and proposed NPDES permits, Missouri's water quality standards and the latest LMD, a list of impaired waters and TMDLs, and opportunities for water resource conservation and grant opportunities.

Access to the department's water quality data is relatively straightforward using online tools. Should additional assistance be needed, general requests for water quality information may be made by calling 1-800-361-4827. Official requests for specific information can be made by submitting an online request form found at http://www.dnr.mo.gov/sunshinerequests.htm. Specific requests that cannot be easily accommodated by the online public database may require the department to search published reports or water quality data files. If the report or data was generated by the department, it can be sent to the requestor through electronic mail or regular mail (a hard copy for small reports and data files, or compact disks for larger data files). If the report or data file did not originate with the department, the request may be passed on to the organization that published the report or data. The requestor is welcome to visit the department office at 1101 Riverside Dr. in Jefferson City and view files directly.

Requests to view water quality data files, should be sent to:

Missouri Department of Natural Resources
Water Protection Program
ATTN: Ms. Trish Rielly
P.O. Box 176
Jefferson City, MO 65102-0176
Phone: (573)526-5297 Fax: (573)526-6802
E-mail: trish.rielly@dnr.mo.gov

C.2. Assessment Methodology

Water quality is judged by its conformance with Missouri's water quality standards. This section describes procedures used by the department to rate the quality of Missouri's waters under this approach, which includes an explanation of the types of data used to determine designated use attainment, how that data is used, and how findings are reported. The assessment methodology is the process the department uses for meeting requirements of CWA Sections 305(b) and 303(d), and it is the basis for summary tables and appendices provided later in this document.

Information Used to Determine Designated Use Attainment
To determine whether or not each designated use is supported, waterbody-specific monitoring data and other relevant information are reviewed against applicable criteria. Monitoring data generated under the four strategic monitoring approaches mentioned in Section C.1. are key elements analyzed in the assessment process. The department also utilizes data from many external sources that are monitoring for similar purposes and are determined to produce data of acceptable quality. Federal agencies collecting such data include USGS, EPA, USFS, USFWS, USACE, and the National Park Service. Other contributors of data include resource agencies from the neighboring states of Illinois, Iowa, Kansas, Arkansas, and Oklahoma; several municipal entities; selected projects from graduate level researchers; MDC fish kill and pollution investigation reports; county public health departments; and, data collected by wastewater dischargers as a condition of their discharge permits (although this data is not used for 303(d) listing purposes). For a complete list of data types and sources, please see Missouri's 2016 LMD, *Methodology for the Development of the 2016 Section 303(d) List in Missouri* (Appendix A).

Water Body Segments
Tables G and H of Missouri's Water Quality Standards published in 10 CSR 20-7.031 contain classifications and use designations for all classified lakes and streams. Each individual waterbody listing in Tables G and H is considered an assessment unit. For each lake in Table G there is only one listing unit. For streams however, single systems may receive multiple classifications according to the character of their natural flow regime (e.g., permanent flow vs. intermittent flow); thus, there may be multiple listings or assessment units in Table H for any given stream or river. For the Mississippi River, water body segments reflect an interstate MOU between five states (Missouri, Illinois, Iowa, Wisconsin, and Minnesota) signed in September, 2003 (UMRBA 2003). The purpose of the MOU is to enhance coordination of water quality assessments and management decisions on the Upper Mississippi River, segmentation points are as follows: Des Moines River-Lock and Dam 21-Cuivre River-Missouri River-Kaskaskia River-Ohio River. Results of UAAs and CWC rulings have affected the designation of recreational uses on the Mississippi River, from the Ohio River to the Missouri River, resulting in further sub-segmentation. Both specific and general criteria may be applied to classified waters of the state. Unclassified waters are usually assessed against general (narrative) criteria and a subset of specific criteria commonly associated with acute toxicity to aquatic life. There are less available data on unclassified waters, and except for 15 streams and lakes, these waters are normally not reported for 305(b) and 303(d) purposes.

Waterbodies are generally assessed individually. For each waterbody, all available data of acceptable quality is reviewed and assessed. That assessment may then be extrapolated to the entire spatial extent of that classified segment. However, the final extent of the assessment may be adjusted to account for significant influences of point source discharges, substantial changes in land use and stream characteristics, and significant hydrologic and channel modifications. In order to adjust the final extent of an assessment, multiple sample points are needed. Occasionally, this method results in assessments that are shorter than the full spatial extent of the classified water body.

C.2.1. Determining Designated Use Attainments
Unique sets of criteria are used to protect specific designated uses assigned to individual waters. Protective criteria include a range of physical, chemical and biological parameters. This means that in order to determine a level of attainment for a designated use, certain types of data must be collected to compare to those protective criteria. Assessing most designated uses involves analyzing multiple parameters, but in some cases, exceeding a single criterion is enough evidence to assess a use as impaired. All classified waters of the state, including large public lakes, are

designated to be protected for whole body and/or secondary contact recreation, protection of aquatic life, fish consumption by humans, and livestock and wildlife watering. A subset of these waters is protected for drinking water supply, irrigation and industrial process, and use as cooling water for industrial processes. This section describes how data and information are used by the department to assess each of these designated uses. For each classified water body, and for each applicable designated use to that water body, department assessments will be in one of four categories:

1) designated use is fully attained;
2) designated use is not attained;
3) designated use not assessed due to an insufficient data; or
4) designated use not assessed.

Generally, a water body use assessment of "fully attained" suggests water quality is fair to excellent, whereas an assessment of "not attained" indicates poor water quality. To what extent resource quality is impacted depends on the degree to which the use is not attained. Waters with at least one designated use assessed as "not attained" are considered impaired. When possible, potential or known causes and sources of the impairment are described.

To make a determination of "fully attained" or "not attained," data from the previous seven years are generally used. In some cases, however, older data are used when they are believed to be representative of present day conditions.

For complete assessment methodology details please see Missouri's 2016 LMD, *Methodology for the Development of the 2016 Section 303(d) List in Missouri* (Appendix A). The 2016 LMD lists all data that may be used for performing water quality based assessments and the applicable statistical methods for interpreting Missouri's water quality standards. Prior to each listing cycle, the LMD goes through a stakeholder input and review process where it can be revised. Development of the 2016 Section 303(d) List and Section 305(b) report was based exclusively on the 2016 LMD. The 2016 LMD and proposed 2018 LMD may also be viewed at http://dnr.mo.gov/env/wpp/waterquality/303d/303d.htm.

Statistical Considerations

For designated use assessment methods, a specific set of statistical procedures are used to determine if exceedances resulting in non-attainment warrant a 303(d) listing. Table B-1 in the 2016 LMD lists all statistical considerations and analytical tools the department uses for listing waters as impaired. For each analytical tool, a specific decision rule and test procedure is provided. Procedures outlined in the LMD are based on data that meet quality assurance and control standards.

Additional Approaches for Determining Designated Use Attainment

While specific designated use assessment procedures are contained in the LMD, there are several approaches that may be applied to all designated uses. Designated use protection may be accomplished in the absence of data, if the stream being assessed has similar land use and geology as a stream that has already received a water quality assessment. In such cases, the same rating must be applied to the stream being assessed, and this information may only be used for 305(b) reporting, not 303(d) listing. Additionally, where models or other dilution calculations indicate noncompliance with allowable pollutant levels, waters may be added to Category 3B (See section *C.2.2. Water Body Assignment Categories*) and considered a high priority for water quality monitoring. For assessing narrative criteria for all designated uses, data types that are

quantifiable can be used. Full attainment with water quality standards is achieved when the stream appearance is typical of reference or control streams in that region of the state. For example, if water color measured using the platinum-cobalt method is significantly higher than an applicable reference stream, the water body would be judged to be in non-attainment of water quality standards.

The department uses its best professional judgment for interpreting data that has been influenced by abnormal weather patterns and/or situations that complicate appropriate interpretation of the data. In some cases, this means data that would normally be adequate to assess a use is actually determined to be inadequate, and additional sampling is required to ensure a confident assessment.

C.2.2. Water Body Assignment Categories

Once all attainment decisions have been made for a given water body, it is then categorized according to a degree of compliance with water quality standards. The department utilizes a five part category system which is helpful for reporting attainment of applicable water quality standards, and in the development of monitoring strategies that respond to resource issues identified in the assessment. The five part categorization process is summarized below.

Category 1: All designated uses are fully attained.

Category 2: Available data indicate that some, but not all, of the designated uses are fully attained.

Subcategory 2A: Available data suggest compliance with Missouri's Water Quality Standards. No impairment is suspected.

Subcategory 2B: Some available data suggest noncompliance with Missouri's Water Quality Standards. Impairment is suspected.

Category 3: There are insufficient data and/or information to assess any designated uses.

Subcategory 3A: Available data suggest compliance with Missouri's Water Quality Standards. No impairment suspected.

Subcategory 3B: Available data suggest noncompliance with Missouri's Water Quality Standards. Impairment is suspected.

Category 4: Available data indicate that at least one designated use is not attained, but a TMDL study is not needed.

Subcategory 4A: Any portion of the water is in non-attainment with state Water Quality Standards due to one or more discrete pollutants, and EPA has approved a TMDL.

Subcategory 4B: Any portion of the water is in non-attainment with state Water Quality Standards due to one or more discrete pollutants, and pollution control requirements (i.e., water quality based permits and/or voluntary watershed control plans) have been issued that are expected to adequately address the pollutant(s) causing the impairment.

Subcategory 4C: Any portion of the water is in non-attainment with state Water Quality Standards and a discrete pollutant(s) or other property of the water does not cause the impairment.

Category 5: At least one discrete pollutant has caused non-attainment with Missouri's Water Quality Standards, and the water does not meet the qualifications for listing as

either Category 4A, 4B, or 4C. Category 5 waters are those that are placed on the state's 303(d) List.

For 303(d) assessment purposes, each data type (e.g., bacterial, toxic chemical, bioassessment) undergoes a particular statistical treatment to determine compliance with water quality standards.

The department uses a weight of evidence approach for assessing narrative criteria with numeric thresholds to determine the existence or likelihood of an impairment and the appropriateness of proposing a listing based on narrative criteria. For Tier Three waters, which includes outstanding state and national waters, no level of water quality degradation is allowed; therefore, assessment of these waters will generally compare current data to either historical data or data from segments that support water quality conditions that existed at the time the state's antidegradation rule was promulgated (April 20, 2007). Based upon earlier guidance from EPA, the department uses a burden-of-proof approach in its hypothesis testing that places emphasis on the null hypothesis. In other words, there must be very convincing data to accept the alternative hypothesis (that the waterbody is impaired).

C.2.3. De-listing Impaired Waters

Several factors may lead to removing a water body from the Section 303(d) list. Removal may occur when a TMDL study addressing all pollutant pairs for a given waterbody has been completed and approved. In situations where an impairment is due solely to a permitted facility, it may be possible to revise the facility's permit to meet the targeted water quality criteria, this is known as a Permit in Lieu of TMDL. Waters that recover from pollution may be de-listed once water quality is assessed as meeting water quality criteria. Analytical tools used for de-listing purposes are described in Missouri's 2016 LMD (see Appendix A). Waters can also be removed as a result of finding errors in the original assessment or listing.

C.2.4. Changes to the 2014 Listing Methodology Document

As noted previously, the LMD may be revised every even numbered year, undergoing the same review and approval schedule as that required for the Section 303(d) list. There were a few revisions made to the 2014 LMD in order to account for changes in the state's water quality standards or to clarify the 2016 assessment procedures. Below is a summary of those revisions, please see the 2016 LMD for exact details related to each change.

- Added clarity to the biological assessment process for fish and aquatic macroinvertebrates with regard to using the "weight of evidence" approach, handling habitat assessments, and the protocols for using candidate reference streams.

- Changed the use of the arithmetic mean to the geometric mean when evaluating data against sediment toxicity thresholds.

C.3. Assessment Results

This section is a summary of the department's surface water assessments for the 2016 assessment cycle. Included in this section is the allocation of designated uses among classified waters, assessment results per monitored and evaluated waters, summary of lake trophic conditions and water quality trends, results of the five-part categorization of surface waters and probability based surveys, the Section 303(d) list, and designated use support summaries.

In Tables G and H of Missouri's Water Quality Standards, all classified lakes and stream segments are identified. Classified waters are designated for recreation, aquatic life and fish consumption, and livestock and wildlife watering, with some waters receiving additional

designations as described earlier. Table 2 below, summarizes designated uses allocated among classified waters in the state.

Table 2. Allocation of designated uses among Missouri's classified waters.

Designated Use	Stream miles	Percent of Total	Lake acres	Percent of Total
Protection of Aquatic Life	115,772	100	363,653	100
Warm-Water Fishery	112,140	97	316,427	87
Cool-Water Fishery	3,273	3	0	0
Cold-Water Fishery	359	<1	47,226	13
Human Health Protection – Fish Consumption	115,772	100	363,653	100
Whole Body Contact Recreation – A	6,269	5	302,613	83
Whole Body Contact Recreation – B	108,855	94	61,040	17
Secondary Contact Recreation	115,772	100	363,653	100
Livestock and Wildlife Watering	115,772	100	363,653	100
Drinking Water Supply	3,551	3	122,363	34
Industrial	1,683	1	6,519	2
Irrigation	115,772	100	363,653	100
Antidegradation				
Outstanding National Resource Waters	202	<1	0	0
Outstanding State Resource Waters	217	<1	270*	<1
Total Classified Waters	115,772		363,653	

**Represents acreage for three marsh wetlands.*

Surface Water Monitoring and Assessment Summary

Designated use assessments were developed using departmental monitoring efforts as described in section C.1., and using data from numerous federal, state, and municipal programs. Due to the state's extensive stream and lake network, it's not feasible to collect adequate data on every classified water body in Missouri. Consequently, only a portion of all classified waters are monitored each assessment cycle. An overview of stream and lake data used for assessment decisions is provided in Tables 3 and 4.

Table 3. Classified stream miles in Missouri that have been monitored, evaluated, and assessed, 2009-2014.

Assessment Result	Monitored (miles)	Evaluated (miles)	Total Assessed
Full Support of Assessed Uses (1, 2A, and 2B)	2,667	2,640	5,307
Impaired for One or More Uses (4A, 4B, 4C, and 5)	3,453	2,096	5,549
Inadequate Data for Use Assessment (3A and 3B)	179	13,726	--
Total Considered (all categories)	--	--	24,761
Stream Miles Not Considered	--	--	91,011

Table 4. Classified lake acreages in Missouri that have been monitored, evaluated, and assessed, 2009-2014.

Assessment Result	Monitored (acres)	Evaluated	Total Assessed
Full Support of Assessed Uses (1, 2A and 2B)	86,812	102,281	189,093
Impaired for One or More Uses (4A, 4B, 4C, and 5)	69,218	3,497	72,715
Inadequate Data for Use Assessment (3A and 3B)	3,344	31,810	--
Total Considered (all categories)	--	--	296,962
Lake Acreages Not Considered	--	--	66,691

Monitored waters include streams and lakes where sufficient water quality data for an assessment have been collected in the past five years. Approximately 5.4 percent of all classified stream miles and 43.8 percent of all classified lake acres are considered to be monitored. Evaluated waters are those waters for which no data are available from the past five years. In these cases, either older data are available, and are considered representative of current conditions; or they have geology and land use similar to nearby monitored waters and their water quality condition is assumed to be similar as well. Totals of 15.9 percent of all classified stream miles and 37.8 percent of all classified lake acres are considered to be evaluated. Unassessed waters are those waters that are not monitored directly and do not have nearby waters with similar geology and land use that are monitored. These represent the classified waters in the state for which an accurate assessment of water quality condition is not possible. Thus, 78.6 percent of classified stream miles and 18.3 percent of classified lake acres are unassessed.

Probability Summary

Data generated by MDC's RAM program served as the primary source of the department's probability based survey. Specifically, Fish IBI scores were used to determine the percentage of streams that fully support aquatic life use. For this survey, data was restricted to 3rd to 5th order streams in the Ozark subregion that were randomly selected and assessed from 2002-2010 (Figure 1). Only IBI scores with accompanying habitat assessments were used. In cases where poor stream habitat quality existed and the fish community was not fully supported, data was excluded from further analysis. Therefore, resulting fish IBI scores are reflective of water quality condition in the stream. Fish IBI scores greater than 36 indicate aquatic life use was supported, whereas scores of 29-36 indicate a community is suspected to be impaired but is at least partially in attainment, and scores less than 29 suggest the community is impaired and aquatic life use is not supported. Habitat scores were based on 6 separate metrics: (1) substrate quality, (2) channel disturbance, (3) channel volume, (4) channel spatial complexity, (5) fish cover, and (6) tractive force and velocity. Together these six metrics make up the QCPH1 score, which to date, is the best overall indicator of habitat condition as assessed using MDC's RAM protocol. Final selection of Fish IBI scores incorporated MDC staff's best professional judgment to insure surveys were not compromised in any fashion.

IBI scores from 192 fish surveys representing approximately 2,590 miles were used in this summary. Classified streams 3rd to 5th order in size contribute to approximately 9,843 stream miles in the Ozarks. Complete results are provided in Table 5.

Table 5. Probability based support summary of aquatic life use in Ozark Streams.

Project Name	MDC RAM Program
Type of Waterbody	Stream
Target Population	3rd to 5th Order, Ozarks Ecoregion
Size of Target Population #sites/miles	192 assessments / 2,589.9 miles
Units of Measurement	Classified stream miles
Designated Use	Aquatic Life
Percent, Miles Attaining	71.4%, 7,048 miles
Percent, Miles Not Attaining	14.1%, 1,437 miles
Percent, Miles Non Response (Suspect)	14.6%, 1,388 miles
Indicator	Biological – Fish IBI
Assessment Date	7/31/2015

Lake Trophic Status

In Missouri, trophic state classification is based on total chlorophyll (ChlT), total nitrogen (TN), total phosphorus (TP) concentrations, and secchi depth (Secchi) measurements. Trophic state is an indicator of a lake's water quality condition in response to nutrient concentrations. The department utilizes four classes for categorizing lakes by trophic state, including: oligotrophic, mesotrophic, eutrophic, and hypereutrophic. Oligotrophic lakes tend to be low in nutrients and chlorophyll concentrations and have high water clarity, whereas hypereutrophic lakes contain the highest levels of nutrients and total chlorophyll concentrations and reduced clarity. Nutrient levels in lakes are the result of both natural processes and anthropogenic influence. The process by which lakes are enriched with nutrients is known as eutrophication, which is generally accelerated by human activities, particularly in agricultural and urban landscapes.

Chlorophyll is the green pigment present in all plant life and is necessary for photosynthesis. The amount present in a lake depends on the amount of algae and thus, is a good measure of water quality conditions. Total nitrogen is the sum of nitrate and nitrite, ammonia, and organically bound nitrogen. Total phosphorus is comprised of soluble phosphorus and the phosphorus bound to organic and inorganic solids suspended in water. Phosphorus is the limiting nutrient for algae growth in most reservoirs in Missouri.

The four variables described above were used to assess lake trophic classifications using Table 6. Missouri lakes may be grouped into one of four trophic classes including oligotrophic, mesotrophic, eutrophic, and hypereutrophic. The method presently used by the department to determine trophic status was originally presented in Jones et al. (2008).

Table 6. Lake trophic classifications defined by total chlorophyll, total nitrogen, and total phosphorus concentrations, and secchi depth.

Trophic Class	ChlT (µg/L)	TN (µg/L)	TP (µg/L)	Secchi (meters)
Oligotrophic	< 3	< 350	<10	≥ 2.6
Mesotrophic	3 - 9	≥ 350 - 550	≥ 10 - 25	≥1.3 - < 2.6
Eutrophic	> 9 - 40	≥ 550 - 1200	≥ 25 - 100	≥ 0.45 - < 1.3
Hypereutrophic	> 40	> 1200	>100	< 0.45

In this report, the trophic status summary was updated to account for data collected through 2014. Trophic status was calculated by averaging seasonal values of chlorophyll and total phosphorus.

Measurements and samples were taken near the surface, over the deepest part of the lake or just upstream of a reservoir dam, typically three to four times between the beginning of May and the end of August. Summarized results are presented in Table 7. For lake-specific trophic status, please see Appendix D.

In the previous version of Missouri's water quality standards, there were 442 classified reservoirs and lakes in the state. This number has increased to 3,066 in the current version of the standards. Both totals exclude 15 waterbodies that are classified as major reservoirs (L2). Approximately ten of the total number are natural lakes occurring within the floodplains of either the Missouri River or the Mississippi River, and the others are man-made reservoirs. Approximately 75 lakes are monitored four or more times during the summer; the monitoring includes analysis of nutrients, suspended solids, and chlorophyll levels, and the measurement of water clarity.

Table 7. Summary of trophic status for Missouri lakes, by natural division.

Trophic Category	Glaciated Plains		Osage Plains		Ozark Border		Ozark Highlands	
	#	acres	#	acres	#	acres	#	acres
Oligotrophic	--	--	--	--	2	--	10	528
Mesotrophic	13	2,029	1	--	13	811	17	80,732
Eutrophic	67	43,072	21	58,671	31	1,237	14	76,949
Hypereutrophic	16	1,623	4	1,648	5	327	--	--
Total	96	46,724	26	60,319	51	2,375	41	158,209

Trophic status was summarized for 214 lakes, of which 196 were classified and 18 were unclassified. Only lakes with at least three years of data, with each year consisting of at least 3 samples between May 1 and August 31, were included in the examination. Trophic classes were grouped by natural divisions with distinct combinations of soils, bedrock geology, topography, plant and animal distribution and pre-settlement vegetation (Thom and Wilson 1980). Natural region divisions are very similar to the primary ecological sections of the classification system developed by Nigh and Schroeder (2002). Based on the data parameters described above, the following may be concluded: approximately 528 acres (0.2%) of lakes are classified as oligotrophic; 83,572 acres (31.2%) are mesotrophic; 179,929 acres (67.2%) are eutrophic; and 3,598 acres (1.3%) are hypereutrophic.

Figure 2. Natural regions of Missouri (Thom and Wilson 1980).

Trophic status varies considerably between the physiographic regions of the state. Oligotrophic lakes are found predominantly in the Ozark Highlands (Ozarks) where the mostly the forested landscape contributes few nutrients through nonpoint sources. Within the Glaciated and Osage Plains regions where agriculture is a widespread land use, the majority of lakes are in the eutrophic category.

Lake Trends

Lake trends were summarized across physiographic sections (Table 8). Only lakes with at least 20 years of data were evaluated. Nineteen lakes contributed to the Glacial Plains region, 12 to the Ozark Highlands, six to the Osage Plains and two to the Ozark Border region. Lakes were monitored for secchi disk depth, total phosphorus, total nitrogen, total chlorophyll, non-volatile suspended solids, and volatile suspended solids. Linear regression was used to evaluate each parameter over the monitoring period. A negative slope indicated a decrease over time, whereas a positive slope indicated an increase.

Table 8. Summary of lake trends (slopes in regression equation) for four physiographic regions in Missouri.

Region	Secchi (m/yr)	TP (µg/L/yr)	TN (µg/L/yr)	ChlT (µg/L/yr)	NVSS (mg/L/yr)	VSS (mg/L/yr)
Glaciated Plains	0.004	0.128	0.989	0.175	-0.055*	0.011
Osage Plains	0.020	0.100	1.568	0.645*	-0.133*	0.020
Ozark Border	-0.014*	0.463	14.120*	1.390*	-0.125*	0.201*
Ozark Highlands	0.110*	-0.218	-0.607	0.128	-0.014	0.019

**Denotes significant trends ($p < 0.05$). TP = Total Phosphorus; TN = Total Nitrogen; ChlT = Total Chlorophyll; NVSS =Nonvolatile Suspended Solids; VSS = Volatile Suspended Solids*

In the Glaciated Plains, there were no significant temporal trends in nutrients or water clarity, but there was a trend of decreasing mineral turbidity. Trend information was limited in the Osage Plains and Ozark Border regions, due to the low number of lakes with sufficient temporal data. Even so, mineral turbidity (i.e., filterable non-algal suspended particles) decreased in both regions. In contrast, total chlorophyll levels increased in both regions. In the Ozark Border region, total nitrogen and volatile suspended solids also increased, while secchi depth decreased. In the Ozark Highlands region, secchi depth increased over time but nutrients and suspended solids variables did not exhibit a temporal pattern.

Identifying trends in lake water quality can be complicated by seasonal variations, changing climate conditions, and data limitations. Trending may be further complicated by grouping lakes according physiographic region. For management purposes, lake trends should be tracked on an individual basis. Additional lake information is provided annually by the LMVP and listed on their website at http://www.lmvp.org/.

Controlling Pollution in Lakes

In Missouri, the three primary sources of NPS pollution include agriculture lands, urban areas, and to a lesser extent, abandoned mine lands. The department operates several programs that address water quality and habitat issues facing lakes and reservoirs in the state. While lake pollution may be addressed through regulatory controls, most activities are voluntary. As previously discussed, volunteer activities are typically addressed by the department's NPS

program and SWCP. For more information regarding these programs, please see *Water Pollution Control Activities*, section B.3. of this report.

In-lake management techniques that were previously funded under CWA Section 314 can now be funded under CWA Section 319 in the context of an appropriate NPS project. Several in-lake management techniques are eligible for CWA Section 319 funding, including water level drawdown, shading, and biological controls such as fish or insects, and planting or harvesting of aquatic plants. The department also works with several watershed groups on a regular basis. At least 77 watershed groups have been formed in Missouri. These groups work to educate and inform landowners of threats to water resources in their area, and promote land management practices that minimize NPS pollution.

The department samples lake water quality as needed, but general monitoring is primarily conducted under two specific programs, SLAP and LMVP. Together, these programs monitor well over 100 lakes each year. Funding for both SLAP and LMVP is provided under CWA Section 319. Outreach activities are a major component of LMVP.

TMDLs also help reduce pollution in Missouri lakes and reservoirs. The program began in 1999 and as of December 2014, eight studies have been completed for lakes, and were focused primarily on reducing nonpoint source pollution contributions. Appendix C shows the proposed schedule of future TMDL studies.

Five-Part Categorization of Surface Waters

Results of the five-part categorization of classified surface waters in Missouri are shown in Table 9. Please see Section C.2.2 for category definitions.

Table 9. Amounts (stream mileage and lake acreage) of surface waters assigned to reporting categories.

Water Body Type	Category									Total Class-ified	Total Assessed
	1	2A	2B	3A	3B	4A	4B	4C	5		
Streams (mi.)	116	4,713	478	10,828	3,077	568	40	401	4,541	115,772	24,761
Lakes (ac.)	0	188,135	957	34,280	874	2,276	0	0	70,439	363,653	296,961

Note: Waters in categories 3A and 3B are considered unassessed. Discrepancies between Tables 3 and 9 are due to rounding in stream segment lengths and lake acreages.

Designated Use Support Summary

Designated uses assigned to classified lakes and streams were individually assessed using site specific information, and summarized results are shown in Tables 10 and 11. Each designated use (aquatic life and fish consumption; whole body contact recreation A and B; secondary contact recreation; drinking water supply; industrial process and cooling water; irrigation; and, livestock and wildlife watering) was assessed as either supporting or not supporting. Designated uses were not assessed for waters without existing data, or for waters where existing data were insufficient to accurately conclude a support level. Totals of 24,761 stream miles and 296,692 lake acres were assessed for at least one designated use, corresponding to 21.4 and 81.6 percent of all classified waters, respectively.

Table 10. Designated use support summary for Missouri's classified streams, 2016.

Designated Use	Full Support	Non-Support	Not Assessed	Total Assessed	Total in State
Protection of Aquatic Life	7,366 (29.7%)	2,778 (11.2%)	14,617 (59.0%)	24,761	115,772
Human Health Protection – Fish Consumption	1,812 (7.3%)	836 (3.4%)	22,114 (89.3%)	24,761	115,772
Cool-Water Fishery	2,073 (63.5%)	93 (2.8%)	1,100 (33.7%)	3,266	
Cold-Water Fishery	99 (33.1%)	0	200 (66.9%)	299	
Whole Body Contact Recreation (A)	1,537 (24.5%)	1,003 (16.0%)	3,741 (59.6%)	6,281	
Whole Body Contact Recreation (B)	554 (3.1%)	1,575 (8.8%)	15,691 (88.1%)	17,820	
Secondary Contact Recreation	4,187 (16.9%)	327 (1.3%)	20,247 (81.8%)	24,761	115,772
Drinking Water Supply	1,598 (45.1%)	0	1,949 (54.9%)	3,547	
Industrial	169 (10.3%)	0	1,474 (89.7%)	1,643	
Irrigation	1,637 (6.7%)	6 (0.0%)	23,117 (93.4%)	24,761	115,772
Livestock and Wildlife Watering	2,799 (11.3%)	0	21,962 (88.7%)	24,761	115,772

Table 11. Designated use support summary for Missouri's classified lakes, 2016.

Designated Use	Full Support	Non-Support	Not Assessed	Total Assessed	Total in State
Protection of Aquatic Life	173,366 (58.4%)	45,368 (15.3%)	78,228 (26.3%)	296,692	363,653
Human Health Protection – Fish Consumption	166,568 (56.1%)	27,990 (9.4%)	102,404 (34.5%)	296,692	363,653
Whole Body Contact Recreation (A)	221,434 (83.4%)	0	44,143 (16.6%)	265,577	
Whole Body Contact Recreation (B)	115 (0.4%)	0	31,162 (99.6%)	31,277	
Secondary Contact Recreation	197,869 (66.7%)	0	99,093 (33.4%)	296,692	363,653
Drinking Water Supply	24,876 (19.5%)	44 (0.0%)	102,749 (80.5%)	127,669	
Irrigation	0	0	296,962 (100%)	296,692	363,653
Industrial	0	0	6,959 100%	6,959	
Livestock and Wildlife Watering	0	0	296,962 100%	296,692	363,653

For each designated use identified as nonsupporting, there may be one to several potential contaminants causing the impairment(s) (Tables 12 and 13). The list of potential contaminants in Tables 12 and 13 is based on waters categorized as 4A, 4B, 4C, and 5. Summarized data are based on site-specific information. When a classified stream segment is identified as impaired, the contaminant(s) is usually considered to impair the entire segment length. However, if available data suggests only a portion of the classified segment is impaired, it is this shorter length which is included in the total impaired stream mileage listed per contaminant, rather than the entire classified segment. When a lake's designated use is impaired, the entire surface area of the lake is considered impaired per contaminant, rather than a smaller portion in closer proximity to the dam outlet where data are collected.

Table 12. Causes of impairments for designated uses assigned to Missouri's classified streams.

Cause/Impairment Type	Impaired Stream Miles	Percent of Total Miles
Bacteria (Fecal Coliform and *E. coli*)	3,677.2	14.85
Low Dissolved Oxygen	1,382.1	5.58
Mercury in Fish Tissue	739.8	2.99
Lead	678.2	2.74
Macroinvertebrate Bioassessments	501.7	2.03
Fish Bioassessments	476.2	1.92
Zinc	334.3	1.35
Cadmium	288.0	1.16
Sediment/Siltation	163.9	0.66
Water Temperature	131.2	0.53
Ammonia (Total and Un-ionized)	86.5	0.35
Chloride	70.5	0.28
Nickel	47.4	0.19
pH	47.2	0.19
Unknown Cause(s)	42.5	0.17
Polycyclic Aromatic Hydrocarbons	40.6	0.16
Biological Indicators of Eutrophication	35.8	0.14
Total Dissolved Solids	35.5	0.14
Dissolved Oxygen Saturation	32.5	0.13
Bedload	18.0	0.07
Total Suspended Solids	9.7	0.04
Copper	8.9	0.04
Sulfates	4.5	0.02
Chlordane in Fish Tissue	4.4	0.02
Arsenic	0.9	<0.01
Total Nitrogen	0.4	<0.01

Table 13. Causes of impairments for designated uses assigned to Missouri's classified lakes.

Cause/Impairment Type	Impaired Lake Acres	Percent of Total Acres
Chlorophyll (Total and Chlorophyll-a)	86,578	29.15
Total Nitrogen	84,744	28.54
Biological Indicators of Eutrophication	83,642	28.17
Mercury in Fish Tissue	28,071	9.45
Total Phosphorus	2,631	0.88
Dissolved Oxygen Saturation	2,119	0.71
Pesticides (Atrazine)	44	0.01

Contaminants that impair designated uses originate from numerous sources. In some cases, a single source is responsible for providing multiple contaminants to the same water body. Impaired stream miles and lake acreages for each contaminant source are listed in Tables 14 and 15. Summarized information is based on site-specific surveys. While contaminants can usually be identified, monitoring limitations can make it difficult to pinpoint exact sources. Despite these limitations, various pollutant sources have been recognized as causing impairments in Missouri's streams and lakes.

Table 14. Contaminant sources for non-supported designated uses assigned to Missouri's classified streams.

Source Category	Impaired Stream Miles	Percent of Total Miles
Unspecified Nonpoint Source	2,638.3	10.7
Source Unknown	1,431.5	5.8
Municipal Point Source	1,187.3	4.8
Atmospheric Deposition (mercury)	739.8	3.0
Urban Runoff/Storm Sewers	305.9	1.2
Industrial Point Source	223.8	0.9
Agriculture	148.0	0.6
Permitted Stormwater Discharge	123.5	0.5
Recreation Pollution Source	61.6	0.2
Habitat Modification other than Hydromodification	41.3	0.2
Natural Conditions	11.9	<0.1
Road/bridge Runoff	6.1	<0.1
Rural or Residential Areas	3.9	<0.1
Upstream Source	3.4	<0.1
Urban or Municipal Source	1.9	<0.1
Mining		
Tailings	1,173.5	4.7
Coal Mining	44.4	0.2
Hardrock, subsurface	4.2	<0.1
Hydrological modification		
Channelization	564.0	2.3
Dam or Impoundment	108.3	0.4
Flow Regulation and Modification	29.0	0.1

Table 15. Contaminant sources for non-supported designated uses assigned to Missouri's classified lakes.

Source Category	Impaired Lake Acres	Percent of Total Acres
Unspecified Nonpoint Source	131,227	44.2
Municipal Point Source	125,241	42.2
Atmospheric Deposition (Mercury)	28,071	9.5
Dam or Impoundment	2,119	0.7
Urban Runoff/Storm Sewers	555	0.2
Rural or Residential Areas	371	0.1
Source Unknown	236	0.1
Agriculture	9	0.0

Section 303(d) Assessment Results – List of Impaired Waters

Under Section 303(d) of the CWA, states are required to develop lists of impaired or threatened waters every two years. An impaired waterbody is defined as having chronic or recurring violations of numeric and/or narrative water quality criteria. Development of the list is based on assessment methods described in section *C.2.1. Determining Designated Use Attainments* and detailed in the 2016 LMD. Missouri's proposed Section 303(d) list is included in Appendix B.

The proposed 2016 Section 303(d) list of impaired waterbodies (approved by the Missouri CWC) includes specific waterbody pollutants, their sources, and estimated impairment size. This proposed list reflects any deletions and additions of water body pollutant pairs since the 2014 Integrated Report. Waterbody pollutant pairs proposed to be removed from Missouri's 2014 Section 303(d) Missouri's are also provided in Appendix B. Waters are typically de-listed when new data shows water quality criteria are no longer exceeded, an assessment method changes, an initial listing error is identified, the EPA established or approved a TMDL, or a permit in lieu of a TMDL was approved by EPA.

In summary, the proposed Section 303(d) List of impaired waters for 2016 includes 448 waterbody pollutant pairs for both classified and unclassified waters. Approximately 8,860 stream miles and 287,800 acres of lakes are categorized as impaired by a specific pollutant. Pollutants most commonly identified include bacteria (126 listings), heavy metals in water or sediment (93), dissolved oxygen (72), and mercury in fish tissue (62). Most common pollutant sources include nonpoint source runoff (agriculture, urban, rural, or unspecified nonpoint sources, mining related impacts, atmospheric deposition, and municipal WWTPs and other point sources.

Twenty-seven pollutant pairs from the 2014 Section 303(d) List were proposed to be removed from the 2016 list. In all cases, de-listing was due to compliance with water quality standards. In a few cases, the return to compliance was attributable to new assessment methods, erroneous listings, or restoration actions. In most cases, however, the recovery reason was unknown. Please see Appendix B for additional details on de-listed waters.

Waterbodies that have been removed from this and previous Section 303(d) lists as a result of an approved TMDL or permit in lieu of a TMDL are listed in Appendix E. These waters were categorized as 4A, 4B, or 4C, and are still considered impaired due to noncompliance with water quality standards. Appendix F lists the waterbodies that are considered potentially impaired, but that do not have sufficient data to conclusively make that assessment.

TMDL Schedule

Under 40 CFR Part 130.7(b), states are required to submit a priority ranking schedule that identifies all waters targeted for TMDL development in the next two years. Each water body-pollutant combination listed in the Section 303(d) list must receive a clear priority ranking. EPA guidance also encourages states to develop TMDLs for each water body-pollutant combinations in a time frame that is no longer than eight to 13 years from the time the water body-pollutant pair was first listed.

The department is considering a three-step process to address the issue of prioritizing TMDL development. First, a scoring process will be developed that considers the designated uses impaired, the pollutant(s) of concern, and the waterbody order or importance. Second, a screening process to rank watersheds on the basis of their potential to recover rapidly and affordably will be applied. Thirdly, stakeholder involvement will be encouraged. Potential stakeholders include landowners, representatives of the regulated community, and representatives of other state or federal agencies. Appendix C shows the proposed schedule of future TMDL studies.

C.4. Wetlands Programs

Waters of the state identified as wetlands are those that meet criteria in the *United States Army Corps of Engineers Wetlands Delineation Manual 1987*. Missouri's current water quality standards lack designated uses specific to wetlands that are supported by numeric water quality criteria; however, as waters of the state, narrative criteria do apply to wetlands. Of the 624,000 estimated wetland acres in the state, three wetland marshes totaling 270 acres are listed as lakes and are considered Outstanding State Resource Waters. Additional information about wetlands in Missouri may be found at http://dnr.mo.gov/env/wrc/wetlands.htm.

Wetlands meeting criteria in the *United States Army Corps of Engineers Wetlands Delineation Manual 1987* and considered jurisdictional are protected under CWA Sections 404 and 401. Persons seeking to alter wetlands through the discharge of "dredge or fill" materials and related impacts (e.g. installing culverts or rip-rap, rerouting streams, wetland fill for development purposes, etc.) must apply for a Section 404 permit with USACE; in conjunction, the applicant must also obtain a Section 401 Water Quality Certification from the department ensuring water quality standards will not be violated and/or appropriate mitigation steps will be taken when impacts are unavoidable.

The department's WPP, under direction by the Missouri CWC and EPA, is working to establish water quality standards for wetlands. The WPP has been awarded a Wetland Program Development Grant by EPA with the goal of establishing a set of reference wetlands in Missouri. In the process, this project will develop methods to identify other candidate reference wetlands using onsite water chemistry and biological sampling. Ultimately, it is intended that reference wetland information may be used as the basis for developing wetland water quality standards and for establishing an IBI for wetlands.

The department's Water Resources Center administers the State Wetlands Conservation Plan, which encourages the protection and restoration of wetlands and provides technical assistance to other agencies involved in wetland issues. With the assistance of other state and federal agencies, and a partnership with University of Missouri, the department has completed several projects. These include studies assessing urban wetlands, identifying types of wetlands through image analysis, wetland nutrient monitoring, determining the hydrology of Missouri riparian wetlands,

and an assessment of specific wetland mitigation sites. Continuous monitoring of wetland hydrology is conducted at six sites in the state.

Numerous state and federal wetland projects have been undertaken to protect and enhance Missouri's wetland resources. Together MDC, USFWS and NRCS have protected more than 260,000 acres of wetlands through easements or purchases, restored more than 43,000 acres, and enhanced more than 41,000 acres in Missouri.

C.5. Public Health Issues

EPA asks states to provide information on public health issues, including information on drinking water supply, whole body contact recreation, and fish consumption advisories. The procedures for determining attainment of each use are provided in section C.2.1, *Determination of Designated Use Attainments*. Please see Tables 10 and 11 for designated use support summaries related to drinking water supply, whole body contact recreation, and fish consumption uses.

Drinking water supply usage is designated for 3,551 stream miles and 122,363 lake acres. This use is not supported in two lakes, Lewistown Lake (Lewis Co., 35 ac.) and Wyaconda Lake (Clark Co., 9 ac.). In both cases, the contaminant is atrazine due to local herbicide applications.

All classified lakes and streams are designated for fish consumption use. For streams, 744.2 miles are impaired due to contaminants in fish tissue. In 13 of 14 streams, the contaminant is mercury and in a single stream (Blue River, Jackson Co.) the contaminant is chlordane. Forty-nine classified lakes covering a total of 28,071 acres are impaired by mercury in fish tissue. Mercury is known to make its way to surface waters through atmospheric deposition; whereas chlordane was previously used as a pesticide and is likely transported to streams during runoff events.

The MDHSS publishes an annual fish advisory and guide for eating fish in state waters. MDHSS's advisory offers guidelines for two populations, all consumers and a sensitive population, which is defined as pregnant women, women of childbearing age, nursing mothers, and children younger than 13. In Missouri, guidelines vary according to water body, fish species and length. Contaminants of concern include mercury, chlordane, lead, and PCBs. For all consumers, recommendations vary from one meal per week to "Do Not Eat" for specific species from certain rivers. The statewide recommendation for the sensitive population is to eat no more than one meal of fish per month. The complete fish advisory guide for 2015 is available in portable document format at http://health.mo.gov/living/environment/fishadvisory/pdf/fishadvisory.pdf.

E. coli is sampled at a select set of designated swimming beaches in the state park system on regular basis during the recreational season. Swimming is discouraged when the geometric mean of weekly sample results exceed 190 *E. coli* colonies per 100 ml of water. Sampling results and beach notifications can be viewed online at http://www.dnr.mo.gov/asp/beaches/index.html.

PART D. GROUNDWATER MONITORING AND ASSESSMENT

Groundwater resources vary considerably in quantity and quality across Missouri. It's estimated that during normal weather cycles, 500 trillion gallons of drinkable groundwater is stored in Missouri's aquifers (Miller and Vandike 1997). Certain aquifers yield high volumes of quality water, whereas in some areas groundwater yields are low and/or contain water that is too mineralized for consumption. This section provides an overview of significant groundwater

resources in the state, groundwater interactions with surface waters, groundwater quality, sources of groundwater contamination, and current monitoring efforts and protection programs.

D.1. Groundwater in Missouri

Approximately 42 percent of Missourians rely on groundwater for drinking water. Groundwater is the primary source of drinking water in the Ozarks and the Southeastern Lowlands for both public and private systems. The cities of St. Joseph, Independence, Columbia, and St. Charles use groundwater from the alluvial aquifer of the Missouri River. In the plains region of the state, many small communities are able to obtain adequate water from shallow alluvial wells near rivers or large creeks, and many individual households still rely on shallow upland aquifers despite small yields.

In the Ozarks, groundwater yields are usually large and of excellent quality, as witnessed by the fact that unlike cities in other areas of the state, many municipalities pump groundwater directly into their water supplies without treatment. However, the geologic character of the Ozarks that supplies it with such an abundance of groundwater, namely its ability to funnel large amounts of rainfall and surface runoff to the groundwater system, can present problems for groundwater quality. This is because much surface water flows directly to groundwater through cracks, fractures or solution cavities in the bedrock, with little or no filtration. Contaminants from leaking septic tanks or storage tanks, or surface waters affected by domestic wastewater, animal feedlots, and other pollution sources can move directly into groundwater through these cavities in the bedrock.

As in the Ozarks, groundwater in the southeast lowlands is abundant and of good quality. Unlike the Ozarks, contaminants are filtered by thick deposits of sand, silt, and clay as they move through the groundwater system. Shallow groundwater wells, however, are subject to the same problems of elevated levels of nitrate or bacteria experienced in the Ozark aquifer and can also have low levels of pesticides. Deep wells are generally unaffected by contaminants.

Shallow groundwater in the plains of northern and western Missouri tends to be somewhat more mineralized and to have taste and odor problems due to high levels of iron and manganese. Like shallow wells in the southeast lowlands, wells in this part of the state can be affected by nitrates, bacteria, or pesticides.

In urban areas, alluvial aquifers of large rivers such as the Missouri and the Meramec which serve water supplies have occasionally been locally contaminated by spills or improper disposal of industrial or commercial chemicals.

D.2. Well Construction and Groundwater Quality

Well construction greatly influences the quality of well water and therefore, state regulations include construction standards for both public and private wells. Public drinking water wells and many private wells are deep, and properly cased and grouted. These wells rarely become contaminated. However, many private wells established prior to the development of construction standards are shallow or not properly cased. These wells can be easily contaminated by septic tanks, feedlots or chemical mixing sites near the well. Studies in Missouri have shown that two-thirds of wells contaminated by pesticides are less than 35 feet deep. The three most common problems in private wells are bacteria, nitrate, and pesticides. Water quality criteria for each of these pollutants can occasionally be exceeded in private wells.

D.3. Major Potable Aquifers in Missouri

Locations of major aquifers providing drinkable water in Missouri are described below. Unconfined aquifers are those influenced by water table conditions (the pressure at the water table is the atmospheric pressure), and tend to yield greater amounts of water, but are also more easily contaminated by activities occurring at the land's surface. In confined aquifers, groundwater is overlain by a low permeable geologic material, and groundwater below is under pressure greater than atmospheric pressure alone. Confined aquifers generally recharge more slowly than unconfined aquifers, but are better protected from surface contaminants.

Glacial Till Aquifer

This aquifer covers most of Missouri north of the Missouri River. The glacial till is an unsorted mixture of clay, sand, and gravel, with occasional boulders and lenses of sand or gravel. Loess, fine wind-blown silt deposits four to eight feet in depth, covers the till on the uplands. In some places, the till is underlain by sorted deposits of sand or gravel. Although this aquifer is unconfined, surface water infiltrates very slowly and groundwater yields are very small. In scattered areas, the till has buried old river channels that remain as large sand or gravel deposits that contain much more groundwater than the till. Some households rely on these areas for drinking water, but it is generally inadequate as a source for municipal water supply.

Alluvial Aquifer

Alluvial aquifers are the unconfined aquifers on the floodplains of rivers and are of Quaternary age. In Missouri, the largest of these aquifers lie along the Missouri and Mississippi rivers, reaching their widest extent in the southeast lowlands, where they extend as far as 50 miles west of the Mississippi River. Many small communities north of the Missouri River use alluvial aquifers of nearby streams as their drinking water supply, and the Missouri River alluvium supplies the cities of St. Joseph, Independence, and Columbia and sections of St. Charles County. In the southeast lowlands, most private water supplies and about 45 percent of people served by public water supplies use water from the alluvial aquifer. Agricultural irrigation consumes much more water in this area of Missouri than does domestic water use. All agricultural irrigation water is drawn from the alluvial aquifer.

Wilcox-McNairy Aquifers

These two aquifers lie beneath much of the alluvial aquifer of the southeast lowlands. They are in unconsolidated or loosely consolidated deposits of marine sands and clays of Tertiary and Cretaceous age. Except where the McNairy aquifer outcrops in the Benton Hills and along Crowley's Ridge, these aquifers are confined. They yield abundant amounts of good quality water, and they provide water for 55 percent of people served by public supplies. In the southeastern part of this region, the deeper of these aquifers, the McNairy, becomes too mineralized to be used for drinking water supply. These two aquifers appear to be unaffected by contaminants of human origin.

Ozark-St. Francois Aquifer

This aquifer covers most of the southern and central two-thirds of Missouri. It is composed of dolomites and sandstones of Ordovician and Cambrian age. Most of the aquifer is unconfined. This aquifer is used for almost all public and private drinking water supplies in this area of Missouri. Exceptions would include supplies in the St. Francois Mountains, such as Fredericktown and Ironton, where the aquifer has been lost due to geologic uplift and erosion, and near Springfield, where demand is so heavy that groundwaters are supplemented with water from three large reservoirs and the James River.

Yields and water quality are typically very good, but in many areas, the bedrock is highly weathered, contains many solution cavities, and can transmit contaminated surface waters into the groundwater rapidly with little or no filtration. Where the confined portion of the aquifer is overlain only by the Mississippian limestones of the Springfield aquifer, the confined Ozark aquifer continues westward for 80 miles or more as a potable water supply, serving the communities of Pittsburg, Kansas and Miami, Oklahoma. However, where it is also overlain by less permeable Pennsylvanian bedrock, the confined Ozark becomes too mineralized for drinking water within 20 to 40 miles.

The unconfined Ozark-St. Francois aquifer is susceptible to contamination from surface sources. Increasing urbanization and increasing numbers of livestock are threats to the integrity of portions of this valuable aquifer.

Springfield Aquifer

This aquifer covers a large portion of southwestern Missouri. It is composed of Mississippian limestones that are highly weathered, particularly in its eastern extent. The aquifer is unconfined and surface water in many areas is readily transmitted to groundwater. Urbanization and livestock production also affect this aquifer. Elevated nitrates and bacterial contamination are common problems in groundwater here.

D.4. Groundwater Contamination, Monitoring, and Protection

Contamination

Major sources of groundwater contamination in Missouri are generally associated with agricultural activities, chemical and waste storage and treatment facilities, industrial and mining processes, and accidental spills. Each contaminant source may lead to one or more contaminants and is typically associated with one or more significant risk factors. Sources of contamination can be prioritized by their contaminants and risk factors, as a result, 10 sources of groundwater contamination are considered priority sources in the state. Please see Table 16 for a list of major sources of groundwater contamination in Missouri, and their related contaminants and associated risk factors.

Table 16. Major sources of groundwater contamination in Missouri.

Contaminant Source	10 Highest Priority Sources (X)[1]	Significant Risk Factors[2]	Contaminants[3]
Agricultural Activities			
Agricultural chemical facilities			
Animal feedlots			
Drainage wells			
Fertilizer applications	X	A,C,D,E	a
Irrigation practices			
Pesticide applications	X	A,B,C,D,E	b
Storage and Treatment Activities			
Land application	X	A,D,E	a,c
Material stockpiles			
Storage tanks (above ground)			
Storage tanks (underground)	X	A,B,C,D,E	d
Surface impoundments			
Waste piles			
Waste tailings			
Disposal Activities			
Deep injection wells			
Landfills			
Septic systems	X	A,D,E	a,c
Shallow injection wells			
Other			
Hazardous waste generators			
Hazardous waste sites	X	A,B,C,D	b,e,f,g
Industrial facilities	X	A,B,C,E	a,h,i,j
Material transfer operations			
Mining and mine drainage	X	A,E	f
Pipelines and sewer lines			
Salt storage and road salting			
Salt water intrusion	X	C	k
Spills	X	A,B,C,E	b,d,e,h
Transportation of materials			
Urban runoff			

[1]Not in order of priority.

[2] A. Human health or environmental toxicity risk
B. Size of population at risk
C. Location of sources relative to drinking water sources
D. Number and/or size of contaminant sources
E. Hydrogeologic sensitivity

[3]a. Nitrate
b. Organic Pesticides
c. Pathogens (Bacteria, Protozoa, Viruses)
d. Petroleum Compounds
e. Halogenated Solvents
f. Metals
g. Radionuclides
h. Ammonia
i. Pentachlorophenol
j. Dioxin
k. Salinity/Brine

Monitoring

The department's Hazardous Waste Program and Public Drinking Water Branch manage activities to protect groundwater and public health. The department's Water Resources Center is responsible for water quantity issues and operates and maintains a network of 168 groundwater

level observation wells for monitoring Missouri's aquifers. While the department does not directly administer a single statewide monitoring program for groundwater quality, such data is collected for specific projects and tracked by both department programs.

The goal of the Hazardous Waste Program is to protect human health and the environment from threats posed by hazardous wastes. One of this program's primary functions is to oversee cleanup of contaminated sites, which may be addressed by one of the department's regulatory programs such as the Comprehensive Environmental Response Compensation and Liability Information System, Leaking Underground Storage Tanks, and Resource Conservation and Recovery Act. Additionally, the program's Federal Facilities Section provides oversight and review of investigations, management and remediation of hazardous substances at facilities currently or previously owned or operated by the Department of Defense or Department of Energy. Furthermore, contaminated sites may be subject to regulation if they are one of the National Priorities Listed sites, cleanup involves underground injections into the aquifer, or they reside on state lands. Table 17 is a summary of groundwater contamination and remediation per source type for 2014 and 2015. More information regarding the Hazardous Waste Program may be found at http://www.dnr.mo.gov/env/hwp/index.html.

Table 17. Groundwater contamination summary for all aquifers, 2014-2015.

Source Type	Number of sites	Number of sites that are listed and/or have confirmed releases	Number with confirmed groundwater contamination	Contaminants*	Number of site investigations	Number of sites that have been stabilized or have had the source removed	Number of sites with corrective action plans	Number of sites with active remediation	Number of sites with cleanup completed
NPL	23	23	23	1,2,3	-	-	-	-	-
CERCLIS (non-NPL)	28	28	28	1,2,3	-	-	-	-	-
DOD/DOE	308	37	33	1,2,3,4	37	226	244	18	57
LUST	3,201	206	180	3	144	61	-	880	72
RCRA Corrective Action	89	55	51	1,2,3,4	51	39	30	29	17
Underground Injection	27	27	27	1,2,3,4	27	-	27	-	
State Sites	1,050	1,050	525	1,2,3,4	1,036	525	525	49	575

NPL - National Priority List; DOE - Department of Energy ; DOD - Department of Defense; CERCLIS - Comprehensive Environmental Response, Compensation, and Liability Information System; LUST - Leaking Underground Storage Tanks; RCRA - Resource Conservation and Recovery Act. Underground Injection - includes sites where chemicals were injected into groundwater as part of approved remediation plan.

*Contaminants: 1- VOAs, SVOAs, Solvents, PCBs, Dioxin, PAHs, Herbicides, Pesticides, Metals, Explosives
2- VOAs, PCBs, Pesticides, Dioxin, Metals, Radionuclides, SVOCs, etc.
3- BTEX, TPH, MTBE, PAHs, Metals, SVOA
4- Creosote, Pentachlorophenol, Organic Solvents, Chlorinated Solvents, Petroleum, Asbestos

The WPP's Public Drinking Water Branch ensures all public water systems provide safe drinking water to people. Public water systems utilizing groundwater may test supply wells for compliance purposes. This data is reviewed and stored in the Public Drinking Water Branch's database. In this reporting cycle, groundwater results are presented for 21counties in southwest Missouri that are underlain by the Springfield Plateau groundwater province, also called the Springfield Aquifer. Taney and Douglas counties were excluded from this summary since only very small portions of each are underlain by the Springfield Plateau groundwater province. Sample parameters were summarized for each public water supply and included nitrate, synthetic organic chemicals (SOCs), and volatile organic chemicals (VOCs). Currently, the department regulates 30 different SOCs and 21 VOCs. Nitrate and VOC levels were measured at detectable levels at some facilities, however, no exceedances of groundwater standards were observed. Exceedances were determined in accordance with maximum contaminant levels per 10 CSR 60-4.030, 10 CSR 60-1.040 and 10 CSR 60-4.100. Please see Table 18 for a summary of groundwater quality in the Springfield Plateau groundwater province.

Table 18. Groundwater quality sample results reported by public drinking water facilities from 21 counties overlying the Springfield Plateau groundwater province, January 1, 2014 through September 30, 2015.

County	Reporting Facilities	Numbers of Detections			Numbers of Exceedances		
		NO_3	SOCs	VOCs	NO_3	SOCs	VOCs
Barry	84	109	0	0	0	0	0
Barton	5	7	3	6	0	0	0
Benton	92	80	0	5	0	0	0
Cedar	29	9	0	0	0	0	0
Christian	44	50	0	7	0	0	0
Cooper	7	4	7	15	0	0	0
Dade	18	15	0	0	0	0	0
Greene	80	52	0	15	0	0	0
Henry	6	12	10	16	0	0	0
Hickory	44	28	0	1	0	0	0
Jasper	35	40	0	46	0	0	0
Johnson	14	12	4	12	0	0	0
Lawrence	32	30	0	0	0	0	0
McDonald	24	20	0	0	0	0	0
Newton	45	40	1	13	0	0	0
Pettis	31	20	0	15	0	0	0
Polk	23	28	0	1	0	0	0
St Clair	15	4	0	0	0	0	0
Stone	237	252	0	8	0	0	0
Vernon	7	18	0	0	0	0	0
Webster	24	27	0	5	0	0	0

While the Water Resources Center focuses on water quantity issues regarding availability and usage, it conducted a statewide screening level survey for pesticides in shallow groundwater wells from 2001 to 2006 (Baumgartner 2006). The purpose of this project was to determine if agricultural pesticides entered groundwater as a result of normal field application. The project focused on four primary pesticides: atrazine, simazine, alachlor, and metolachlor. Samples were collected from 190 wells, of which 186 showed no measurable levels of specific pesticides. Of the four wells that showed some level of pesticide

contamination in groundwater, no samples contained concentrations above maximum contaminant levels listed under EPA guidelines at that time.

Groundwater Protection

Different programs within the department are responsible for certain aspects of groundwater protection. Please see Table 19 for a summary of groundwater protection programs or activities carried out by the state of Missouri. Please visit the department's website at http://www.dnr.mo.gov/ for additional information on specific groundwater protection programs.

Table 19. Summary of groundwater protection programs in Missouri.

Program or Activities	Check (X)	Implementation Status	Responsible State Agency
Active SARA Title III Program	X	Fully Established	MDPS/SEMA
Ambient Groundwater Monitoring System		N/A	
Aquifer Mapping and Characterization	X	Continuing Effort	DNR
Aquifer Vulnerability Assessment		N/A	
Comprehensive Data Management System		N/A	
EPA-Endorsed Core Comprehensive State Groundwater Protection Program		N/A	
Groundwater Best Management Practices	X	Continuing Effort	DNR
Groundwater Classification		N/A	
Groundwater Discharge Permits	X	Fully Established	DNR
Groundwater Legislation	X	Developed	DNR
Groundwater-Level Observation Network	X	Fully Established	DNR
Groundwater Monitoring at Sanitary Landfills	X	Fully Established	DNR
Groundwater Quality Standards	X	Fully Established	DNR
Interagency Coordination for Groundwater Protection Initiatives	X	Fully Established	DNR
Nonpoint Source Controls	X	Continuing Effort	DNR
Pesticide State Management Plan	X	Developed	MDA
Pollution Prevention Program	X	Continuing Effort	DNR
Resource Conservation and Recovery Act (RCRA) Primacy	X	Fully Established	DNR
State RCRA Program Incorporating More Stringent Requirements Than RCRA Primacy	X	Fully Established	DNR
State Septic System Regulations	X	Fully Established	MDHSS
State Superfund	X	Fully Established	DNR
Underground Injection Control Program	X	Fully Established	DNR
Underground Storage Tank Installation Requirements	X	Fully Established	DNR
Underground Storage Tank Permit Program		N/A	
Underground Storage Tank Remediation Fund		N/A	
Vulnerability Assessment for Drinking Water/ Wellhead Protection	X	Fully Established	DNR
Well Abandonment Regulations	X	Fully Established	DNR
Wellhead Protection Program (EPA-Approved)	X	Fully Established	DNR
Well Installation Regulations	X	Fully Established	DNR

MDPS/SEMA: Missouri Department of Public Safety, State Emergency Management Agency
MDA: Missouri Department of Agriculture
MDHSS: Missouri Department of Health and Senior Services

PART E. PUBLIC PARTICIPATION

In accordance with federal CWA regulation and Missouri Revised Statute 644.036.5, the department provides several opportunities for the public to participate in the development of the Section 303(d) list. The LMD receives public review as well and is approved pursuant to 10 CSR 20-7.050. The public comment period for the proposed 2016 Section 303(d) List and 2018 LMD was opened on October 1, 2015 and closed January 31, 2016. Both documents were posted on the department's Section 303(d) website at http://dnr.mo.gov/env/wpp/waterquality/303d/303d.htm throughout the comment period. Assessment worksheets for proposed water body listings were also included on the webpage. During the comment period, two public information sessions were held at the Lewis and Clark State Office Building in Jefferson City, one on November 3 and another on December 1. Additionally, a public hearing on both the proposed Section 303(d) list and 2018 LMD was held on January 6, 2016 with a member of the Missouri's Clean Water Commission in attendance. Video and audio from the hearing can be found on the CWC's website at http://dnr.mo.gov/env/wpp/cwc/index.html. The public notice was posted in six major newspapers circulated primarily in and around the cities of St. Louis, Kansas City, Springfield, Kirksville, Columbia, and Cape Girardeau.

Summaries of each information session were posted on the department's Section 303(d) website following each meeting, and have been included with all administrative records submitted with the Section 303(d) list package to EPA. During each session, both impaired waterbody listing decisions and the 2018 LMD were reviewed and discussed with members of the 303(d) stakeholder group and others in attendance. The department responded to all questions and comments received during the public notice period. Responses to public comments regarding the Section 303(d) list are included in Appendix G. Responses to public comments regarding the 2018 LMD will be posted to the department's Section 303(d) website at a later date. Missouri's Section 303(d) list was approved by the CWC during a public meeting held on April 6, 2016.

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APPENDIX A

Methodology for the Development of the 2016 Section 303(d) List

APPENDIX B

2016 Missouri Section 303(d) List of Impaired Waters

APPENDIX C

TMDL Schedule and Section 303(d) Prioritization

APPENDIX D

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APPENDIX E

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APPENDIX F

Potentially Impaired Waters

APPENDIX G

Responsiveness Summary

Methodology for the Development

of the

2016 Section 303(d) List in Missouri

Final July 9, 2014

Missouri Department of Natural Resources
Division of Environmental Quality
Water Protection Program

Missouri
Department of
Natural Resources

Methodology for the Development of the 2016 Section 303(d) List

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I. Citation and Requirements

A. Citation of Section of Clean Water Act

This document is required by revisions of rules under the Federal Clean Water Act, Section 303(d), 40 CFR 130.7, and the timetable for presenting the finished document to the United States Environmental Protection Agency (EPA) and the public is given in Part 130.10. Section 303(d) requires states to list certain impaired waters and the rules require that states describe how this list will be constructed. Missouri fulfills reporting requirements under Sections 303(d), 305(b) and 314 of the Clean Water Act by the submission to EPA of an integrated report at the time the Section 303(d) list is approved by the Missouri Clean Water Commission. In years when no integrated report is submitted, the Missouri Department of Natural Resources (Department) submits a copy of its statewide water quality assessment database to EPA.

B. U.S. EPA Guidance

In July 2003, EPA issued new guidance entitled "Guidance for 2004 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d) and 305(b) of the Clean Water Act." This guidance gave further recommendations about listing of 303(d) and other waters. In July 2005, EPA published an amended version entitled "Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act" (Appendix A). In October 2006, EPA issued a memorandum entitled "Information Concerning 2008 Clean Water Act Sections 303(d), 305(b) and 314 Integrated Reporting and Listing Decisions." This memorandum serves as EPA's guidance for the 2008 reporting cycle and beyond. In subsequent years, EPA has provided additional guidance, but only limited new supplemental information has been provided since the 2008 cycle. Additional information can be found at EPA's website: http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/guidance.cfm.

The Department is responsible for administration of the Federal Clean Water Act in Missouri. EPA regulations require that the Department describe the methodology used to develop the state's 303(d) list. Biennially, the methodology is reviewed and revised as necessary, and made available to the public for review and comment. In accordance with the guidance, the Department provides EPA with a document summarizing all comments received and the Department responses to significant comments. EPA's guidance recommends the Department provide: (1) a description of the methodology used to develop the Section 303(d) list; (2) a description of the data and information used to identify (impaired and threatened) waters, including a description of the existing and readily available data and information used; and (3) a rationale for any decision for not using any existing and readily available data and information. The guidance also notes that "prior to submission of its Integrated Report, each state should provide the public with the opportunity to review and comment on the methodology." The guidelines further recommend that the methodology document include information on how interstate or international disagreements concerning the list are resolved.

Placement of Waters within the Five Categories in the 2006[1] EPA Assessment, Listing and Reporting Guidance

The guidance issued by EPA in 2006 recommends all waters of the state be placed in one of five categories.

Category 1

All designated beneficial uses are fully maintained. Data or other information supporting full beneficial use attainment for all designated beneficial uses must be consistent with the state's Listing Methodology Document (LMD). The Department will place a water in Category 1 if the following conditions are met:

- The water has physical and chemical data (at a minimum, water temperature, pH, dissolved oxygen, ammonia, total cobalt, and total copper for streams, and total nitrogen, total phosphorus and secchi depth for lakes) and biological water quality data (at a minimum, *E. coli* or fecal coliform bacteria) that indicates attainment with water quality standards.
- The level of mercury in fish fillets or plugs used for human consumption does not exceed fish tissue guidelines of 0.3 mg/kg or less. Only samples of higher trophic level species (largemouth, smallmouth and Kentucky Spotted bass, sauger, walleye, northern pike, trout, striped bass, white bass, flathead catfish and blue catfish) will be used.
- The water is not rated as "threatened."

Category 2

One or more designated beneficial uses are fully attained but at least one designated beneficial use has inadequate data or information to make a use attainment decision consistent with the state's LMD. The Department will place a water in Category 2 if at least one of the following conditions are met:

- There is inadequate data for water temperature, pH, dissolved oxygen, ammonia, total cobalt or total copper in streams to assess attainment with water quality standards or inadequate total nitrogen, total phosphorus or secchi data in lakes.
- There is inadequate *E. coli* or fecal coliform bacteria data to assess attainment with the whole body contact recreational use.
- There is insufficient fish fillet tissue, or plug data available for mercury to assess attainment with the fish consumption use.

Category 2 waters will be placed in one of two sub-categories.

[1] http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/upload/2005_08_11_tmdl_2006IRG_report_2006irg-sec5.pdf

Category 2A: Waters will be placed in this category if available data, using best professional judgement, suggests compliance with numeric water quality criteria of Tables A or B in Missouri's Water Quality Standards (10 CSR 20-7.031) or other quantitative thresholds for determining use attainment.

Category 2B: Waters will be placed in this category if the available data, using best professional judgment, suggests noncompliance with numeric water quality criteria of Tables A or B in Missouri's Water Quality Standards, or other quantitative thresholds for determining use attainment, and this data is insufficient to support a statistical test or to qualify as representative data. Category 2B waters will be given high priority for additional water quality monitoring.

Category 3

Water quality data are not adequate to assess any of the designated beneficial uses consistent with the LMD. The Department will place a water in Category 3 if data are insufficient to support a statistical test or to qualify as representative data to assess any of the designated beneficial uses. Category 3 waters will be placed in one of two sub-categories.

Category 3A. Waters will be placed in this category if available data, using best professional judgement, suggests compliance with numeric water quality criteria of Tables A or B in Missouri's Water Quality Standards (10 CSR 20-7.031) or other quantitative thresholds for determining use attainment.

Category 3B. Waters will be placed in this category if the available data, using best professional judgement, suggests noncompliance with numeric water quality criteria of Tables A or B in Missouri's Water Quality Standards or other quantitative thresholds for determining use attainment. Category 3B waters will be given high priority for additional water quality monitoring.

Category 4

State Water Quality Standards or other criteria, as per the requirements of Table 1 of this document, are not attained, but a Total Maximum Daily Load (TMDL) study is not required. Category 4 waters will be placed in one of three sub-categories.

Category 4A. EPA has approved a TMDL study that addresses the impairment. The Department will place a water in Category 4A if both the following conditions are met:

- Any portion of the water is rated as being in non-attainment with state Water Quality Standards or other criteria as explained in Table 1 of this document due to one or more discrete pollutants or discrete properties of the water[2], and
- EPA has approved a TMDL for all pollutants that are causing non-attainment.

[2] A discrete pollutant or a discrete property of water is defined here as a specific chemical or other attribute of the water (such as temperature, dissolved oxygen or pH) that causes beneficial use impairment and that can be measured quantitatively.

Category 4B. Water pollution controls required by a local, state or federal authority, are expected to correct the impairment in a reasonable period of time. The Department will place a water in Category 4B if **both** of the following conditions are met:

- Any portion of the water is rated as being in non-attainment with state Water Quality Standards or other criteria as explained in Table 1 of this document due to one or more discrete pollutants or discrete properties of water[2], and
- A water quality based permit that addresses the pollutant(s) causing the designated use impairment has been issued and compliance with the permit limits will eliminate the impairment; or other pollution control requirements have been made that are expected to adequately address the pollutant(s) causing the impairment. This may include implemented voluntary watershed control plans as noted in EPA's guidance document.

Category 4C. Any portion of the water is rated as being in non-attainment with state Water Quality Standards or other criteria as explained in Table 1 of this document, and a discrete pollutant(s) or other discrete property of the water[2] does not cause the impairment. Discrete pollutants may include specific chemical elements (e.g., lead, zinc), chemical compounds (e.g., ammonia, dieldrin, atrazine) or one of the following quantifiable physical, biological or bacteriological conditions: water temperature, percent of gas saturation, amount of dissolved oxygen, pH, deposited sediment, toxicity or counts of fecal coliform or *E. coli* bacteria.

Category 5

At least one discrete pollutant has caused non-attainment with state Water Quality Standards or other criteria as explained in Table 1 of this document, and the water does not meet the qualifications for listing as either Categories 4A or 4B. Category 5 waters are those that are candidates for the state's 303(d) List[3].

If a designated use is not supported and the segment is impaired or threatened, the fact that a specific pollutant is not known does not provide a basis for excluding a segment from Category 5. These segments must be listed as Category 5 unless the state can demonstrate that no discrete pollutant or pollutants causes or contributes to the impairment. Pollutants causing the impairment will be identified through the 303(d) assessment and listing process before a TMDL study is written. The TMDL should be written within the time frame preferred in EPA guidance for TMDL development, when it fits within the state's TMDL prioritization scheme.

Threatened Waters

When a water that would otherwise be in Categories 1, 2, or 3 has a time trend analysis for one or more discrete water quality pollutants indicates the water is currently maintaining all beneficial uses but will not continue to meet these uses before the next listing cycle, it will be considered a "threatened water." A threatened water will be treated as an impaired water and placed in the appropriate Category (4A, 4B, or 5).

[3] The proposed state 303(d) List is determined by the Missouri Clean Water Commission and the final list is determined by the U.S. Environmental Protection Agency.

II. The Methodology Document

A. Procedures and Methods Used to Collect Water Quality Data

Department Monitoring

The major purposes of the Department's water quality monitoring program are:

- to characterize background or reference water quality conditions;
- to better understand daily, flow event and seasonal water quality variations and their underlying processes;
- to characterize aquatic biological communities;
- to assess time trends in water quality;
- to characterize local and regional impacts of point and nonpoint source discharges on water quality;
- to check for compliance with Water Quality Standards or wastewater permit limits;
- to support development of strategies, including Total Maximum Daily Loads, to return impaired waters to compliance with Water Quality Standards. All of these objectives are statewide in scope.

Coordination with Other Monitoring Efforts in Missouri

To maximize efficiency, the Department routinely coordinates its monitoring activities to avoid overlap with other agencies, and to provide and receive interagency input on monitoring study design. Data from other sources is used for meeting the same objectives as Department sponsored monitoring. The agencies most often involved are the U.S. Geological Survey, the U.S. Army Corps of Engineers, EPA, the Missouri Department of Conservation, and the Missouri Department of Health and Senior Services. The Department also tracks the monitoring efforts of the National Park Service, the U.S. Forest Service, several of the state's larger cities, the states of Oklahoma, Arkansas, Kansas, Iowa and Illinois, and graduate level research conducted at universities within Missouri. For those wastewater discharges where the Department has required instream water quality monitoring, the Department may also use monitoring data acquired by wastewater dischargers as a condition of discharge permits issued by the department. In 1995, the Department also began using data collected by volunteers that have passed Quality Assurance/Quality Control tests.

Existing Monitoring Networks and Programs

The following list is a description of the kinds of water quality monitoring activities presently occurring in Missouri.

1. Fixed Station Network

   A. Objective: To better characterize background or reference water quality conditions, to better understand daily, flow event, and seasonal water quality variations and their

underlying processes, to assess time trends and to check for compliance with Water Quality Standards.

B. Design Methodology: Sites were chosen based on one of the following criteria:
   - Site is believed to have water quality representative of many neighboring streams of similar size due to similarity in watershed geology, hydrology and land use, and the absence of any impact from a significant point or discrete nonpoint water pollution source.
   - Site is downstream of a significant point source or discrete nonpoint source area.

C. Number of Sites, Sampling Methods, Sampling Frequency, and Parameters:
   - Department/U.S. Geological Survey cooperative network: 70 sites statewide, horizontally and vertically integrated grab sampled, six to 12 times per year. Samples are analyzed for major ions, nutrients, temperature, pH, dissolved oxygen, specific conductance and flow on all visits, two to four times annually for suspended solids and heavy metals, and for pesticides six times annually at six sites.
   - Department/University of Missouri-Columbia's lake monitoring network. This program has monitored about 249 lakes since 1989. About 75 lakes are monitored each year. Each lake is usually sampled four times during the summer and about 12 are monitored spring through fall for nutrients, chlorophyll, turbidity and suspended solids.
   - Department routine monitoring of finished public drinking water supplies for bacteria and trace contaminants.
   - Routine bacterial monitoring of swimming beaches at Missouri's state parks during the recreational season by the Department's Division of State Parks.
   - Monitoring of sediment quality by the Department at approximately 10 discretionary sites annually. All sites are monitored for several heavy metals and organic contaminants.

2. Special Water Quality Studies

A. Objective: Special water quality studies are used to characterize the water quality impacts from a specific pollutant source area.

B. Design Methodology: These studies are designed to determine the contaminants of concern based on previous water quality studies, effluent sampling and/or Missouri State Operating Permit applications. These studies employ multiple sampling stations downstream and upstream (if appropriate). If contaminants of concern have significant seasonal or daily variation, season of the year and time of day variation must be accounted for in the sampling design.

C. Number of Sites, Sampling Methods, Sampling Frequency and Parameters: The Department conducts or contracts for 10 to15 special studies annually, as funding allows. Each study has multiple sampling sites. Number of sites, sampling frequency and

parameters all vary greatly depending on the study. Intensive studies would also require multiple samples per site over a relatively short time frame.

3. Toxics Monitoring Program

The fixed station network and many of the Department's intensive studies monitor for toxic chemicals. In addition, major municipal and industrial dischargers must monitor for toxicity in their effluents as a condition of their Missouri State Operating Permit.

4. Biological Monitoring Program

A. Objectives: The objectives of this program are to develop numeric criteria describing "reference" aquatic macroinvertebrate and fish communities in Missouri's streams, to implement these criteria within state Water Quality Standards and to continue a statewide fish and aquatic invertebrate monitoring program.

B. Design Methodology: Development of biocriteria for invertebrates and fish involves identification of reference streams in each of Missouri's 17 ecological drainage units. It also includes intensive sampling of invertebrate and fish communities to quantify temporal and spatial variation in reference streams within ecoregions and variation between ecoregions, and the sampling of chemically and physically impaired streams to test sensitivity of various community metrics to differences in stream quality.

C. Number of Sites, Sampling Methods, Sampling Frequency and Parameters: The Department has conducted biological sampling of aquatic invertebrates for many years. Since 1991, this program has consisted of standardized monitoring of approximately 55 sites twice annually. The Missouri Department of Conservation presently has a statewide fish and aquatic invertebrate monitoring program, the Resource Assessment and Monitoring (RAM) Program, designed to assess and monitor the health of Missouri's stream resources. This program samples a minimum of 450 random and 30 reference sites every five years.

5. Fish Tissue Monitoring Program

A. Objective: Fish tissue monitoring can address two separate objectives. These are: (1) the assessment of ecological health or the health of aquatic biota (usually accomplished by monitoring whole fish samples); and (2) the assessment of human health risk based on the level of contamination of fish tissue plugs, or fillets.

B. Design Methodology: Fish tissue monitoring sites were chosen based on one of the following criteria:

- Site is believed to have water and sediment quality representative of many neighboring streams or lakes of similar size due to similarity in geology, hydrology and land use, and the absence of any known impact from a significant point source or discrete nonpoint water pollution source.

- Site is downstream of a significant point source or discrete nonpoint source area.
- Site has shown fish tissue contamination in the past.

C. Number of Sites, Sampling Methods, Sampling Frequency and Parameters:

The Department plans to maintain fish tissue monitoring program to collect whole fish composite samples[4] at approximately12 fixed sites. In previous years, this was a cooperative effort between EPA and the Department. Each site will be sampled once every two years. The preferred species for these sites are either carp or redhorse sucker.

The Department, EPA, and the Missouri Department of Conservation also sample 40 to 50 discretionary sites annually for two fish fillet composite samples or plug samples (mercury only) from fish of similar size and species. One sample is of a top carnivore such as largemouth bass, smallmouth bass, walleye or sauger. The other sample is for a species of a lower trophic level such as catfish, carp or sucker. This program occasionally samples fish eggs for certain fish species at selected locations. Both of these monitoring programs analyze for several chlorinated hydrocarbon insecticides, PCBs, lead, cadmium, mercury, and fat content.

6. Volunteer Monitoring Program

Two major volunteer monitoring programs are now generating water quality data in Missouri. The first is the Lakes of Missouri Volunteer Program. This cooperative program consists of persons from the Department, the University of Missouri-Columbia and volunteers that monitor approximately 137 sites on 66 lakes, including Lake Taneycomo, Table Rock Lake and several lakes in the Kansas City area. Data from this program is used by the university as part of a long-term study on the limnology of midwestern reservoirs.

The second program involves volunteers who monitor water quality of streams throughout Missouri. The Volunteer Water Quality Monitoring Program is a subprogram of the Missouri Stream Team Program, a cooperative project sponsored by the Department, the Missouri Department of Conservation and the Conservation Federation of Missouri. By the end of 2012 over 5,000 citizen volunteers had attended at least one training workshop. After the introductory class, many proceed on to at least one more class of higher level training: Levels 1, 2, 3 and 4. Each level of training is a prerequisite for the next higher level, as is appropriate data submission. Data generated by Levels 2, 3, and 4 and the new Cooperative Site Investigation Program volunteers represent increasingly higher quality assurance. Of those completing an introductory course, about 35 percent proceed to Levels 1 and 2. One hundred-two volunteers have reached Level 3 and six volunteers have reached Level 4. The Cooperative Site Investigation Program uses trained volunteers to collect samples and transport them to laboratories approved by the Department. Volunteers and Department staff work together to develop a monitoring plan. Currently there are 25 volunteers qualified to work in the Cooperative Site Investigation Program. All Level 2, 3, and 4 volunteers as well as all CSI trained volunteers are required to attend a validation session every 3 years to insure, equipment,

[4] A composite sample is one in which several individual fish are combined to produce one sample.

reagents and methods meet our standards. To date 70 individuals have attended a validation session at least once.

Laboratory Analytical Support

Laboratories used:

- Department/U.S. Geological Survey Cooperative Fixed Station Network: U.S. Geological Survey Lab, Denver, Colorado
- Intensive Surveys: Varies, many are done by the Department's Environmental Services Program
- Toxicity Testing of Effluents: Many commercial laboratories
- Biological Criteria for Aquatic Invertebrates: Department's Environmental Services Program and University of Missouri-Columbia
- Fish Tissue: EPA Region VII Laboratory, Kansas City, Kansas and miscellaneous contract laboratories (Missouri Department of Conservation)
- Missouri State Operating Permit: Self-monitoring or commercial laboratories
- Department's Public Drinking Water Monitoring: Department's Environmental Services Program and commercial laboratories
- Other water quality studies: Many commercial laboratories

B. Identification of All Existing and Readily Available Water Quality Data Sources:

The following data sources are used by the Department to aid in the compilation of the state's 305(b) report. Where quality assurance programs are deemed acceptable, these sources would also be used to develop the state's Section 303(d) list. These sources presently include but are not limited to:

1. Fixed station water quality and sediment data collected and analyzed by the Department's Environmental Services Program personnel.
2. Fixed station water quality data collected by the U.S. Geological Survey under contractual agreements with the Department.
3. Fixed station water quality data collected by the U.S. Geological Survey under contractual agreements to agencies or organizations other than the Department.
4. Fixed station water quality, sediment quality and aquatic biological information collected by the U.S. Geological Survey under their National Stream Quality Accounting Network and the National Water Quality Assessment Monitoring Programs.
5. Fixed station raw water quality data collected by the Kansas City Water Services Department, the St. Louis City Water Company, the Missouri American Water Company (formerly St. Louis County Water Company), Springfield City Utilities and Springfield's Department of Public Works.

6. Fixed station water quality data collected by the U.S. Army Corps of Engineers. The Kansas City, St. Louis and Little Rock Corps Districts have monitoring programs for Corps-operated reservoirs in Missouri.
7. Fixed station water quality data collected by the Arkansas Department of Environmental Quality, the Kansas Department of Health and Environment, the Iowa Department of Natural Resources, and the Illinois Environmental Protection Agency.
8. Fixed station water quality monitoring by corporations**.**
9. Annual fish tissue monitoring programs by the Environmental Protection Agency/Department Regional Ambient Fish Tissue Monitoring Program and the Missouri Department of Conservation.
10. Special water quality surveys conducted by the Department. Most of these surveys are focused on the water quality impacts of specific point source wastewater discharges. Some surveys are of well-delimited nonpoint sources such as abandoned mined lands. These surveys often include physical habitat evaluation and monitoring of aquatic invertebrates as well as water chemistry monitoring.
11. Special water quality surveys conducted by U.S. Geological Survey, including but not limited to:
    a) Geology, hydrology and water quality of various hazardous waste sites,
    b) Geology, hydrology and water quality of various abandoned mining areas,
    c) Hydrology and water quality of urban nonpoint source runoff in St. Louis, Kansas City and Springfield, Missouri, and
    d) Bacterial and nutrient contamination of streams in southern Missouri.
12. Special water quality studies by other agencies such as the Missouri Department of Conservation, the U.S. Public Health Service, and the Missouri Department of Health and Senior Services.
13. Monitoring of fish occurrence and distribution by the Missouri Department of Conservation.
14. Fish Kill and Water Pollution Investigations Reports published by the Missouri Department of Conservation.
15. Selected graduate research projects pertaining to water quality and/or aquatic biology.
16. Water quality, sediment and aquatic biological data collected by the Department, the Environmental Protection Agency or their contractors at hazardous waste sites in Missouri.
17. Self-monitoring of receiving streams by cities, sewer districts and industries, or contractors on their behalf, for those discharges that require this kind of monitoring. This monitoring includes chemical and sometimes toxicity monitoring of some of the larger wastewater discharges, particularly those that discharge to smaller streams and have the greatest potential to affect instream water quality.
18. Compliance monitoring of receiving waters by the Department and EPA. This can include chemical and toxicity monitoring.

19. Bacterial monitoring of streams and lakes by county health departments, community lake associations and other organizations using acceptable analytical methods.

20. Other monitoring activities done under a quality assurance project plan approved by the Department.

21. Fixed station water quality and aquatic invertebrate monitoring by volunteers who have successfully completed the Volunteer Water Quality Monitoring Program Level 2 workshop. Data collected by volunteers who have successfully completed a training Level 2 workshop is considered to be Data Code One. Data generated from Volunteer Training Levels 2, 3 and 4 are considered "screening" level data and can be useful in providing an indication of a water quality problem. For this reason, the data is eligible for use in distinguishing between waters in Categories 2A and 2B or Categories 3A and 3B. Most of this data is not used to place waters in main Categories (1, 2, 3, 4 and 5) because analytical procedures do not use EPA or Standard Methods approved methods. Data from volunteers who have not yet completed a Level 2 training workshop do not have sufficient quality assurance to be used for any assessment purposes. Data generated by volunteers while participating in the Department's Cooperative Site Investigation Program (Section II C1) or other volunteer data that otherwise meets the quality assurance outlined in Section II C2 can be used in the Section 303(d) assessment process.

    The following data sources (22-23) **cannot** be used rate a water as impaired (Categories 4A, 4B, 4C or 5); however, these data sources may be used to direct additional monitoring that would allow a water quality assessment for Section 303(d) listing purposes.

22. Fish Management Basin Plans published by the Missouri Department of Conservation.

23. Fish Consumption Advisories published annually by the Missouri Department of Health and Senior Services. Note: the Department may use data from data source No. 9 (as listed above) to list individual waters as impaired due to contaminated fish tissue.

The Department will review all data of acceptable quality that is submitted to the Department prior to the end of the first public notice of the draft 303(d) list. The Department reserves the right to review and use data of acceptable quality submitted after this date if the data results in a change to the assessment status of the water.

C. Data Quality Considerations

1. DNR Quality Assurance/Quality Control Program

   The Department and EPA Region VII have completed a Quality Management Plan. All environmental data generated directly by the Department, or through contracts funded by the Department, or EPA require a Quality Assurance Project Plan. The agency or organization responsible for collection and/or analysis of the environmental sampling

must write and adhere to a Quality Assurance Project Plan approved through the Department's Quality Management Plan. Any environmental data generated by a monitoring plan with a Department approved Quality Assurance Project Plan is considered suitable for use in the 303(d) assessment process. This includes data generated by volunteers participating in the Department's Cooperative Site Investigation Program. Under this program, the Department's Environmental Services Program will audit selected non-profit (governmental and university) laboratories. Laboratories that pass this audit will be approved for the Cooperative Site Investigation Program. Individual volunteers that collect samples and deliver them to an approved laboratory must first successfully complete Department training in proper collection and handling of samples. The kind of information that should allow the department to make a judgment on the acceptability of a quality assurance program are: (1) a description of the training, and work experience of the persons involved in the program, (2) a description of the field meters used and maintenance and calibration procedures used, (3) a description of sample collection and handling procedures and (4) a description of all analytical methods used for samples taken to a laboratory for analysis.

2. Other Quality Assurance/Quality Control Programs

Data generated in the absence of a Department-approved Quality Assurance Project Plan may be used to determine the 303(d) status of a waterbody if the Department determines that the data is scientifically defensible after making a review of the quality assurance procedures used by the data generator. This review would include: (1) names of all persons involved in the monitoring program, their duties and a description of training and work related experience, (2) all written procedures, Standard Operating Procedures, or Quality Assurance Project Plans pertaining to this monitoring effort, (3) a description of all field methods used, brand names and model numbers of any equipment and a description of calibration and maintenance procedures, and (4) a description of laboratory analytical methods. This review may also include an audit by the Department's Environmental Services Program.

3. Other Data Quality Considerations

3.1 Data Age. For assessing present conditions, more recent data is preferable; however, older data can be used to assess present conditions if the data remains representative of present conditions.

If the Department uses data to make a Section 303(d) list decision that predates the date the list is initially developed by more than seven years, the Department will provide a written justification for the use of such data.

A second consideration is the age of the data relative to significant events that may have an effect on water quality. Data collected prior to the initiation, closure or significant change in a wastewater discharge, or prior to a large spill event or the reclamation of a mining or hazardous waste site, for example, may not be representative of present conditions. Such data would not be used to assess present conditions even if it was less

than seven years old. Such "pre-event" data can be used to determine changes in water quality before and after the event or to show water quality time trends.

3.2 Data Type, Amount and Information Content. EPA recommends establishing a series of data codes, and rating data quality by the kind and amount of data present at a particular location (EPA 1997[5]). The codes are single digit numbers from one to four, indicating the relative degree of assurance the user has in the value of a particular environmental data set. Data Code One indicates the least assurance or the least number of samples or analytes and Data Code Four the greatest. Based on EPA's guidance, the Department uses the following rules to assign code numbers to data.

- Data Code[6] One: All data not meeting the requirements of Data Code Two, Three or Four.

- Data Code Two: Chemical data collected quarterly to bimonthly for at least three years, or intensive studies that monitor several nearby sites repeatedly over short periods of time, or at least three fish tissue samples per water body, or at least five bacterial samples collected during the recreational season of one calendar year.

- Data Code Three: Chemical data collected at least monthly for more than three years on a variety of water quality constituents including heavy metals and pesticides; or quantitative biological monitoring of at least one aquatic assemblage (fish, invertebrates or algae) at multiple sites, or multiple samples at a single site when data from that site is supported by biological monitoring at an appropriate control site.

- Data Code Four: Chemical data collected at least monthly for more than three years that provides data on a variety of water quality constituents including heavy metals and pesticides, and including chemical sampling of sediments and fish tissue; or quantitative biological monitoring of at least two aquatic assemblages (fish, invertebrates or algae) at multiple sites.

In Missouri, the primary purpose of Data Code One data is to provide a rapid and inexpensive method of screening large numbers of waters for obvious water quality problems and to determine where more intensive monitoring is needed. In the preparation of the state's 305(b) report, data from all four data quality levels are used. Most of the data is of Data Code One quality, and without Data Code One data, the Department would not be able to assess a majority of the state's waters.

In general, when selecting water bodies for the Missouri 303(d) List, only Data Code Two or higher data are used, unless the problem can be accurately characterized by Data

[5] *Guidelines for the Preparation of the Comprehensive State Water Quality Assessments (305b) and Electronic Updates*, 1997. (http://water.epa.gov/type/watersheds/monitoring/repguid.cfm)
[6] Data Code One is equivalent to data water quality assurance Level One in 10 CSR 20-7.050 General Methodology for Development of Impaired Waters List, subsection (2)(C), Data Code Two is equivalent to Level 2, etc.

Code One data.[7] The reason is that Data Code Two data provides a higher level of assurance that a Water Quality Standard is actually being exceeded and that a TMDL study is necessary. All water bodies placed in Categories 2B or 3B receive high priority for additional monitoring so that data quality is upgraded to at least Data Code Two.

D. How Water Quality Data is Evaluated to Determine Whether or Not Waters are Impaired for 303(d) Listing Purposes

Physical, Chemical, Biological and Toxicity Data

Each reporting cycle, the Department and stakeholders review and revise the guidelines for determining water quality impairment. These guidelines are shown in Tables 1.1 and 1.2 which provide the general rules of data use and assessment and Tables B-1 and B-2 provide details about the specific analytical procedure used. In addition, if time trend data indicates that presently unimpaired waters will become impaired prior to the next listing cycle, these "threatened waters" will be judged to be impaired. Where antidegradation provisions in Missouri's Water Quality Standards apply, those provisions shall be upheld. The numeric criteria included in Table 1.1 have been adopted into the state Water Quality Standards, 10 CSR 20-7.031, and are used, as described in Table 1.1, to make use attainment decisions.

For narrative criteria, the numeric thresholds included in Table 1.2 have not been adopted into state Water Quality Standards. The Department will use a weight of evidence analysis for evaluating all narrative criteria. Under the weight of evidence approach, all available information is examined and the greatest weight is given to data that provide the best supporting evidence. In determining the order of best supporting evidence, best professional judgment will be used to consider factors such as data quality and site-specific environmental conditions. For those analytes with numeric thresholds, the threshold values given in Table 1.2 will trigger a weight of evidence analysis to determine the existence or likelihood of a use impairment and the appropriateness of proposing a 303(d) listing based on narrative criteria. This weight of evidence analysis will include the use of other types of environmental data when it is available or collection of additional data to make the most informed use attainment decision. Examples of other relevant environmental data might include biological data on fish or aquatic invertebrate animals or toxicity testing of water or sediments. See Appendix E for clarification on use of the weight of evidence approach.

When the weight of evidence analysis suggests, but does not provide strong, scientifically defensible evidence of impairment, the Department will place the water body in question in Categories 2B or 3B. The Department will produce a document showing all relevant data and the rationale for the use attainment decision. All such documents will be made available to the public at the time of the first public notice of the proposed 303(d) list. A final recommendation on the listing of a water body based on narrative criteria will only be made after full consideration of all comments on the proposal.

[7] When a listing, amendment or delisting of a 303(d) water is made with only Data Code One data, a document will be prepared that includes a display of all data and a presentation of all statistical tests or other evaluative techniques that documents the scientific defensibility of the data. This requirement applies to all Data Code One data identified in Table 1.1 of this document.

For the interpretation of macroinvertebrate data, where habitat assessment scores indicate habitat is less than 75 percent of reference or appropriate control stream scores, and in the absence of other data indicating impairment by a discrete pollutant, a waterbody judged to be impaired will be placed in Category 4C. When interpreting fish community data, a provisional multi-metric habitat index called the QCPH1 index is used to identify habitat in poor condition (Appendix E). The QCPH1index separates adequate habitat from poor habitat using a 0.39 threshold value; whereby, QCPH1 scores < 0.39 indicate stream habitat is of poor quality, and scores greater than 0.39 indicate available stream habitat is adequate. In the absence of other data indicating impairment by a discrete pollutant, impaired fish communities with poor habitat will be placed in Category 4C. Additional information related to the evaluation of biological data is provided in Appendix E.

For toxic chemicals occurring in benthic sediments, data interpretation will include calculation of a geometric mean for specific toxins from an adequate number of samples, and comparing that value to a corresponding Probable Effect Concentration given by MacDonald *et al.* (2000). The Probable Effect Concentration (PEC) is the level of a pollutant at which harmful effects on the aquatic community are likely to be observed. MacDonald (2000) gave an estimate of accuracy for the ability of individual PECs to predict toxicity. For all metals except arsenic, pollutant geometric means will be compared to 150% of the recommended PEC values. This comparison should meet confidence requirements applied elsewhere in the LMD. When multiple contaminants occur in sediment, toxicity may occur even though the level of each individual pollutant does not reach toxic levels. The method of estimating the synergistic effects of multiple pollutants in sediments given in MacDonald *et al.* (2000) includes the calculation of a PEC Quotient (PECQ). Please see Appendix D for an example calculation of a PECQ. PECQs greater than 0.75 will be judged as toxic.

For the interpretation of toxicity test data, standard acute or chronic bioassay procedures using freshwater aquatic fauna such as, but not limited to, *Ceriodaphnia dubia, Pimephales promelas* or *Hyalella azteca* will provide adequate evidence of toxicity for 303(d) listing purposes. Microtox toxicity tests may be used to list a water as affected by "toxicity" only if there is data of another kind (freshwater toxicity tests, sediment chemistry, water chemistry or biological sampling) that indicates water quality impairment.

For any given water, available data may occur throughout the system and/or be concentrated in certain areas. When the location of pollution sources are known, the Department reserves the right to assess data representative of impacted conditions separately from data representative of unimpacted conditions. Pollution sources include those that may occur at discrete points along a water body, or those which are more diffuse.

TABLE 1.1. METHODS FOR ASSESSING COMPLIANCE WITH WATER QUALITY STANDARDS USED FOR 303(D) LISTING PURPOSES: NUMERIC CRITERIA THAT ARE INCLUDED IN STATE WATER QUALITY STANDARDS, 10 CSR 20-7.031

DESIGNATED USES	DATA TYPE	DATA QUALITY CODE	COMPLIANCE WITH WATER QUALITY STANDARDS[8]
Overall use protection (all designated uses)	No data. Evaluated based on similar land use/ geology as stream with water quality data.[9]	Not applicable	Given same rating as monitored stream with same land use and geology.
Any designated uses	No data available or where only effluent data is available. Results of dilution calculations or water quality modeling	Not applicable	Where models or other dilution calculations indicate noncompliance with allowable pollutant levels and frequencies noted in this table, waters may be added to Category 3B and considered high priority for water quality monitoring.
Protection of Aquatic Life	Water temperature, pH, total dissolved gases, oil and grease.	1-4	Full: No more than 10% of all samples exceed criterion.[10] Non-Attainment: Requirements for full attainment not met.
Losing Streams	E. coli bacteria	1-4	Full: No more than 10% of all samples exceed criterion. Non-Attainment: Requirements for full attainment not met. The criterion for E. coli is 126 counts/100ml. 10 CSR 20-7.031 (4)(C)

[8] See section on Statistical Considerations, Table B-1 and B-2.

[9] This data type is used only for wide-scale assessments of aquatic biota and aquatic habitat for 305(b) Report purposes. This data type is not used in the development of the 303(d) List.

[10] Some sampling periods are wholly or predominantly during the critical period of the year when criteria violations occur. Where the monitoring program presents good evidence of a demarcation between seasons where criteria exceedences occur and seasons when they do not, the 10% exceedence rate will be based on an annual estimate of the frequency of exceedence.

TABLE 1.1. METHODS FOR ASSESSING COMPLIANCE WITH WATER QUALITY STANDARDS USED FOR 303(D) LISTING PURPOSES: NUMERIC CRITERIA THAT ARE INCLUDED IN STATE WATER QUALITY STANDARDS, 10 CSR 20-7.031

DESIGNATED USES	DATA TYPE	DATA QUALITY CODE	COMPLIANCE WITH WATER QUALITY STANDARDS[8]
Protection of Aquatic Life	Dissolved oxygen	1-4	Full: No more than 10% of all samples exceed criterion. Non-Attainment: Requirements for full attainment not met.
Protection of Aquatic Life	Toxic chemicals	1-4	Full: No more than one acute toxic event in three years that results in a documented die-off of aquatic life such as fish, mussels, and crayfish (does not include die-offs due to natural origin). No more than one exceedence of acute or chronic criterion in the last three years for which data is available. Non-Attainment: Requirements for full attainment not met.
Protection of Aquatic Life	Nutrients in Lakes (total phosphorus, total nitrogen, chlorophyll)	1-4	Full: Nutrient levels do not exceed Water Quality Standards following procedures stated in Table B-1. Non-Attainment: Requirements for full attainment not met.[11]
Fish Consumption	Chemicals (water)	1-4	Full: Water quality does not exceed Water Quality Standards following procedures stated in Table B-1. Non-Attainment: Requirements for full attainment not met.
Drinking Water Supply -Raw Water.[12]	Chemical (toxics)	1-4	Full: Water Quality Standards not exceeded following procedures stated in Table B-1. Non-Attainment: Requirements for full attainment not met.

[11] Nutrient criteria will be used in the 2016 LMD only if these criteria appear in the Code of State Regulations, and have not been disapproved by the U.S. Environmental Protection Agency.
[12] Raw water is water from a stream, lake or ground water prior to treatment in a drinking water treatment plant.

TABLE 1.1. METHODS FOR ASSESSING COMPLIANCE WITH WATER QUALITY STANDARDS USED FOR 303(D) LISTING PURPOSES: NUMERIC CRITERIA THAT ARE INCLUDED IN STATE WATER QUALITY STANDARDS, 10 CSR 20-7.031

DESIGNATED USES	DATA TYPE	DATA QUALITY CODE	COMPLIANCE WITH WATER QUALITY STANDARDS[8]
Drinking Water Supply- Raw Water	Chemical (sulfate, chloride, fluoride)	1-4	Full: Water Quality Standards not exceeded following procedures stated in Table B-1. Non-Attainment: Requirements for full attainment not met.
Drinking Water Supply-Finished Water	Chemical (toxics)	1-4	Full: No Maximum Contaminant Level violations based on Safe Drinking Water Act data evaluation procedures. Non-Attainment: Requirements for full attainment not met. NOTE: Finished water data will not be used for analytes where water quality problems may be caused by the drinking water treatment process such as the formation of Trihalomethanes (THMs) or problems that may be caused by the distribution system (bacteria, lead, copper).
Whole-Body-Contact Recreation and Secondary Contact Recreation	Fecal coliform or *E. coli* count	2-4	Where there are at least five samples per year taken during the recreational season: Full: Water Quality Standards not exceeded as a geometric mean, in any of the last three years for which data is available, for samples collected during seasons for which bacteria criteria apply.[13] Non-Attainment: Requirements for full attainment not met.
Irrigation, Livestock and Wildlife Water	Chemical	1-4	Full: Water Quality Standards not exceeded following procedures stated in Table B-1. Non-Attainment: Requirements for full attainment not met.

[13] A geometric mean of 206 cfu/100 ml for E. coli will be used as a criterion value for Category B Recreational Waters. Because Missouri's Fecal Coliform Standard ended December 31, 2008, any waters appearing on the 2008 303(d) List as a result of the Fecal Coliform Standard will be retained on the list with the pollutant listed as "bacteria" until sufficient E. coli sampling has determined the status of the water.

TABLE 1.2. METHODS FOR ASSESSING COMPLIANCE WITH WATER QUALITY STANDARDS USED FOR 303(D) LISTING PURPOSES: NARRATIVE CRITERIA BASED ON NUMERIC THRESHOLDS NOT CONTAINED IN STATE WATER QUALITY STANDARDS (10 CSR 20-7.031)

BENEFICIAL USES	DATA TYPE	DATA QUALITY CODE	COMPLIANCE WITH WATER QUALITY STANDARDS[8]
Overall use protection (all beneficial uses)	Narrative criteria for which quantifiable measurements can be made.	1-4	Full: Stream appearance typical of reference or appropriate control streams in this region of the state. Non-Attainment: The weight of evidence, based on the narrative criteria in 10 CSR 20-7.031(3), demonstrates the observed condition exceeds a numeric threshold necessary for the attainment of a beneficial use. For example: Color: Color as measured by the Platinum-Cobalt visual method (SM 2120 B) in a waterbody is statistically significantly higher than a control water. Objectionable Bottom Deposits: The bottom that is covered by sewage sludge, trash or other materials reaching the water due to anthropogenic sources exceeds the amount in reference or control streams by more than twenty percent. Note: Waters in mixing zones and unclassified waters which support aquatic life on an intermittent basis shall be subject to acute toxicity criteria for protection of aquatic life. Waters in the initial Zone of Dilution shall not be subject to acute toxicity criteria.
Protection of Aquatic Life	Toxic Chemicals	1-4	Full: No more than one acute toxic event in three years (does not include ~~fish kills~~ die-offs of aquatic life due to natural origin). No more than one exceedence of acute or

TABLE 1.2. METHODS FOR ASSESSING COMPLIANCE WITH WATER QUALITY STANDARDS USED FOR 303(D) LISTING PURPOSES: NARRATIVE CRITERIA BASED ON NUMERIC THRESHOLDS NOT CONTAINED IN STATE WATER QUALITY STANDARDS (10 CSR 20-7.031)

BENEFICIAL USES	DATA TYPE	DATA QUALITY CODE	COMPLIANCE WITH WATER QUALITY STANDARDS[8]
			chronic criterion in three years for all toxics.[14, 15] Non-Attainment: Requirements for full attainment not met.

[14] The test result must be representative of water quality for the entire time period for which acute or chronic criteria apply. For ammonia the chronic exposure period is 30 days, for all other toxics 96 hours. The acute exposure period for all toxics is 24 hours, except for ammonia which has a one hour exposure period. The Department will review all appropriate data, including hydrographic data, to insure only representative data is used. Except on large rivers where storm water flows may persist at relatively unvarying levels for several days, grab samples collected during storm water flows will not be used for assessing chronic toxicity criteria.

[15] In the case of toxic chemicals occurring in benthic sediment rather than in water, the numeric thresholds used to determine the need for further evaluation will be the Probable Effect Concentrations proposed in "Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems" by MacDonald, D.D. et al. Arch. Environ. Contam. Toxicol. 39,20-31 (2000). These - Probable Effect Concentrations are as follows: 33 mg/kg As; 4.98 mg/kg Cd; 111 mg/kg Cr; 149 mg/kg Cu; 48.6 mg/kg Ni; 128 mg/kg Pb; 459 mg/kg Zn; 561 µg/kg naphthalene; 1170 µg/kg phenanthrene; 1520 µg/kg pyrene; 1050 µg/kg benzo(a)anthracene, 1290 µg/kg chrysene; 1450 µg/kg benzo(a)pyrene; 22,800 µg/kg total polyaromatic hydrocarbons; 676 µg/kg total PCBs. Chlordane 17.6 ug/kg; Sum DDE 31.3 ug/kg; Lindane (gamma-BHC) 4.99 ug/kg. Where multiple sediment contaminants exist, the Probable Effect Concentrations Quotient shall not exceed 0.75. See Table B-1 and Appendix D for more information on the Probable Effect Concentrations Quotient.

TABLE 1.2. METHODS FOR ASSESSING COMPLIANCE WITH WATER QUALITY STANDARDS USED FOR 303(D) LISTING PURPOSES: NARRATIVE CRITERIA BASED ON NUMERIC THRESHOLDS NOT CONTAINED IN STATE WATER QUALITY STANDARDS (10 CSR 20-7.031)

BENEFICIAL USES	DATA TYPE	DATA QUALITY CODE	COMPLIANCE WITH WATER QUALITY STANDARDS[8]
Protection of Aquatic Life	Biological: Aquatic Macroinvertebr-ates sampled using DNR Protocol.[16, 17]	3-4	Full: For seven or fewer samples and following DNR wadeable streams macroinvertebrate sampling and evaluation protocols, 75% of the stream condition index scores must be 16 or greater. Fauna achieving these scores are considered to be very similar to regional reference streams. For greater than seven samples or for other sampling and evaluation protocols, results must be statistically similar to representative reference or control stream.[18] Non-Attainment: For seven or fewer samples and following DNR wadeable streams macroinvertebrate sampling and evaluation protocols, 75% of the stream condition index scores must be 14 or lower. Fauna achieving these scores are considered to be substantially different from regional reference streams. For more than seven samples or for other sampling and evaluation protocols, results must be statistically dissimilar to control or representative reference streams.
	Biological: MDC Fish Community (RAM) Protocol (Ozark Plateau only)[17]	3-4	Full: For seven or fewer samples and following MDC RAM fish community protocols, 75% of the IBI scores must be 36 or greater. Fauna achieving these scores are considered to be very similar to regional reference streams. For greater than seven samples or for other sampling and evaluation protocols, results must be

[16] DNR invert protocol will not be used for assessment in the Mississippi Alluvial Basin (bootheel area) due to lack of reference streams for comparison.
[17] See Appendix E for additional criteria used to assess biological data.
[18] See Table B-1 and B-2. For test streams that are significantly smaller than bioreference streams where both bioreference streams and small control streams are used to assess the biological integrity of the test stream, the assessment of the data should display and take into account both types of control streams.

TABLE 1.2. METHODS FOR ASSESSING COMPLIANCE WITH WATER QUALITY STANDARDS USED FOR 303(D) LISTING PURPOSES: NARRATIVE CRITERIA BASED ON NUMERIC THRESHOLDS NOT CONTAINED IN STATE WATER QUALITY STANDARDS (10 CSR 20-7.031)

BENEFICIAL USES	DATA TYPE	DATA QUALITY CODE	COMPLIANCE WITH WATER QUALITY STANDARDS[8]
			statistically similar to representative reference or control streams.[18] <u>Suspected of Impairment</u>: Data not conclusive (Category 2B or 3B). For first and second order streams IBI score < 29. Non-Attainment: First and second order streams will not be assessed for non-attainment. When assessing third to fifth order streams with data sets of seven or fewer samples collected by following MDC RAM fish community protocols, 75% of the IBI scores must be lower than 36. Fauna achieving these scores are considered to be substantially different from regional reference streams. For more than seven samples or for other sampling and evaluation protocols, results must be statistically dissimilar to control or representative reference streams. [19,20]
	Other Biological Data[17]	3-4	Full: Results must be statistically similar to representative reference or control streams. Non-Attainment: Results must be statistically dissimilar to control or representative reference streams.

[19] IBI Scores are from "Biological Criteria for Streams and Fish Communities in Missouri" 2008. Doisy et al. for MDC. If habitat limitations (as measured by either the QCPH1 index or other appropriate methods) are judged to contribute to low fish community scores and this is the only type of data available, the water body will be included in Category 4C, 2B, or 3B. If other types of data exist, the weight of evidence approach will be used as described in this document.

[20] For determining influence of poor habitat on those samples that are deemed as impaired, consultation with MDC RAM staff will be utilized. If, through this consultation, habitat is determined to be a significant possible cause for impairment, the water body will not be rated as impaired, but rather as suspect of impairment (categories 2B or 3B).

TABLE 1.2. METHODS FOR ASSESSING COMPLIANCE WITH WATER QUALITY STANDARDS USED FOR 303(D) LISTING PURPOSES: NARRATIVE CRITERIA BASED ON NUMERIC THRESHOLDS NOT CONTAINED IN STATE WATER QUALITY STANDARDS (10 CSR 20-7.031)

BENEFICIAL USES	DATA TYPE	DATA QUALITY CODE	COMPLIANCE WITH WATER QUALITY STANDARDS[8]
Protection of Aquatic Life	Toxicity testing of streams or lakes using aquatic organisms	2	Full: No more than one test result of statistically significant deviation from controls in acute or chronic test in a three-year period. Non-Attainment: Requirements for full attainment not met.
Fish Consumption	Chemicals (tissue)	1-2	Full: Fish tissue levels in fillets, tissue plugs, and eggs do not exceed guidelines.[21] Non-Attainment: Requirements for full attainment not met.

Duration of Assessment Period

Except where the assessment period is specifically noted in Table 1.1, the time period for which data will be used in making the assessments will be determined by data age and data code considerations, as well as representativeness considerations such as those described in footnote 14.

Assessment of Tier Three Waters

Waters given Tier Three protection by the antidegradation rule at 10 CSR 20-7.031(2), shall be considered impaired if data indicate water quality has been reduced in comparison to its historical quality. Historical quality is determined from past data that best describes a water body's water quality following promulgation of the antidegradation rule and at the time the water was given Tier Three protection.

[21] Fish tissue threshold levels are; chlordane 0.1 mg/kg (Crellin, J.R. 1989, *"New Trigger Levels for Chlordane in Fish-Revised Memo"* Mo. Dept. of Health inter-office memorandum. June 16, 1989); mercury 0.3 mg/kg based on "Water Quality Criterion for Protection of Human Health: Methylmercury" EPA-823-R-01-001. Jan. 2001. http://www.epa.gov/waterscience/criteria/methylmercury/merctitl.pdf; PCBs 0.75 mg/kg, MDHSS Memorandum August 30, 2006 *"Development of PCB Risk-based Fish Consumption Limit Tables*"; and lead 0.3 mg/kg (World Health Organization 1972. *"Evaluation of Certain Food Additives and the Contaminants Mercury, Lead and Cadmium".* WHO Technical Report Series No. 505, Sixteenth Report on the Joint FAO/WHO Expert Committee on Food Additives. Geneva 33 pp. Assessment of Mercury will be based on samples solely from the following higher trophic level fish species; walleye, sauger, trout, black bass, white bass, striped bass, northern pike, flathead catfish and blue catfish. In a 2012 DHSS memorandum (not yet approved, but are being considered for future LMD revisions) threshold values are proposed to change as follows: Chlordane 1.2 mg/kg ; Mercury 0.27 mg/kg ; and PCBs = 0.540 ; lead has not changed, but they do add atrazine and PDBEs **(Fish Fillet Advisory Concentrations (FFACs) in Missouri).**

Historical data gathered at the time waters were given Tier Three protection will be used if available. Because historical data may be limited, the historical quality of the waters may be determined by comparing data from the assessed segment with data from a "representative" segment. A representative segment is a body or stretch of water that best reflects the conditions that probably existed at the time the antidegradation rule first applied to the waters being assessed. Examples of possible representative data include 1) data from segments upstream from assessed segments that receive discharges of the quality and quantity that mimic historical discharges to the assessed segment, and 2) data from other bodies of water in the same ecoregion having a similar watershed and landscape and receiving discharges and runoff of the quality and quantity that mimic historical discharges to the assessed segment. The assessment may also use data from the assessed segment gathered between the time of the initiation of Tier Three protection and the last known point in time in which upstream discharges, runoff and watershed conditions remained the same, if the data do not show any significant trends of declining water quality during that period.

The data used in the comparisons will be tested for normality and an appropriate statistical test will be applied. The null hypothesis for such test will be that water quality is the same at the test segment and representative segment. This will be a one-tailed test (the test will consider only the possibility that the assessed segment has poorer water quality) with the alpha level of 0.1, meaning that the test must show greater than a 90 percent probability that the assessed segment has poorer water quality than the representative segment before the assessed segment can be listed as impaired.

Other Types of Information

1. Observation and evaluation of waters for noncompliance with state narrative water quality criteria. Missouri's narrative water quality criteria, as described in 10 CSR 20-7.31 Section (3), may be used to evaluate waters when a quantitative value can be applied to the pollutant. These narrative criteria apply to both classified and unclassified waters and prohibit the following in waters of the state:
    a. Unsightly, putrescent or harmful bottom deposits,
    b. Oil, scum and floating debris,
    c. Unsightly color, turbidity or odor,
    d. Substances or conditions causing toxicity to human, animal or aquatic life,
    e. Human health hazard due to incidental contact,
    f. Acute toxicity to livestock or wildlife, when used as a drinking water supply,
    g. Physical, chemical or hydrologic changes that impair the natural biological community,
    h. Used tires, car bodies, appliances, demolition debris, used vehicles or equipment and any solid waste as defined by Missouri's Solid Waste Law, and
    i. Acute toxicity.

2. Habitat assessment protocols for wadeable streams have been established and are conducted in conjunction with sampling of aquatic macroinvertebrates and fish. Methods for evaluating aquatic macroinvertebrate and fish community data include assessment procedures that account for the presence or absence of representative habitat quality. The Department will not use habitat assessment data alone for assessment purposes.

E. Other 303(d) Listing Considerations

1. Adding to the Existing List or Expanding the Scope of Impairment to a Previously Listed Water

   The listed portion of an impaired water may be increased based on recent monitoring data following the guidelines in this document. One or more new pollutants may be added to the listing for a water already on the list based on recent monitoring data following these same guidelines. Waters not previously listed may be added to the list following the guidelines in this document.

2. Deleting from the Existing List or Decreasing the Scope of Impairment to a Previously Listed Water

   The listed portion of an impaired water may be decreased based on recent monitoring data following the guidelines in this document. One or more pollutants may be deleted from the listing for a water already on the list based on recent monitoring data following guidelines in Table B-2. Waters may be completely removed from the list for several reasons[22], the most common being (1) water has returned to compliance with water quality standards, or (2) the water has an approved TMDL study or Permit in Lieu of a TMDL.

3. Prioritization of Waters for TMDL Development

   Section 303(d) of the Clean Water Act and federal regulation 40 CFR 130.7(b)(4) require states to submit a priority ranking of waters requiring TMDLs. The Department will prioritize development of TMDLs based on several variables including:

   - severity of the water quality problem and risk to public health,
   - amount of time necessary to acquire sufficient data to develop the TMDL,
   - court orders, consent decrees or other formal agreements,
   - budgetary constraints, and
   - amenability of the problem to treatment.

   The Department's TMDL schedule will represent its prioritization. The TMDL Program develops the TMDL schedule which can be found at the following website, http://www.dnr.mo.gov/env/wpp/tmdl/.

4. Resolution of Interstate/International Disagreements

[22] See, "Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act". USEPA, Office of Water, Washington DC.

The Department will review the draft 303(d) Lists of all other states with which it shares a border (Missouri River, Mississippi River, Des Moines River and the St. Francis River) or other interstate waters. Where the listing in another state is different than in Missouri, the Department will request the data upon which the listing in the other state is based. This data will be reviewed following all data evaluation guidelines previously discussed in this document. The Missouri Section 303(d) list may be changed pending the evaluation of this additional data.

Appendix A

Excerpt from *Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act.* July 29, 2005. USEPA pp. 39-41.

G. How should statistical approaches be used in attainment determinations?

The state's methodology should provide a rationale for any statistical interpretation of data for the purpose of making an assessment determination.

1. Description of statistical methods to be employed in various circumstances:

The methodology should provide a clear explanation of which analytic tools the state uses and under which circumstances. EPA recommends that the methodology explain issues such as the selection of key sample statistics (arithmetic mean concentration, median concentration, or a percentile), null and alternative hypotheses, confidence intervals, and Type I and Type II error thresholds. The choice of a statistic tool should be based on the known or expected distribution of the concentration of a pollutant in the segment (e.g., normal or log normal) in both time and space.

Past EPA guidance, 1997 305(b) and 2000 CALM, recommended making non-attainment decisions for "conventional pollutants" – Total Suspended Solids, pH, Biochemical Oxygen Demand, fecal coliform bacteria and oil and grease – when more than 10% of measurements exceed the water quality criterion; however, EPA guidance has not encouraged use of the 10% rule with other pollutants, including toxics. Use of this rule when addressing conventional pollutants, is appropriate if its application is consistent with the manner in which the applicable water quality criterion are expressed. An example of a water quality criterion for which an assessment based on the 10% rule would be appropriate is the EPA acute water quality criterion for fecal coliform bacteria, applicable to protection of water contact recreational use. This 1976-issued water quality criterion was expressed as, "...no more than ten percent of the samples exceeding 400 CFU per 100ml, during a 30-day period. This assessment methodology is clearly reflective of the water quality criterion.

On the other hand, use of the 10 percent rule for interpreting water quality data is usually not consistent with water quality criterion expressed either as: (1) instantaneous maxima not to be surpassed at any time; or (2) average concentrations over specified times. In the case of "instantaneous maxima (or minima) never to occur" criteria use of the 10 percent rule typically leads to the belief that segment conditions are equal to or better than specified by the water quality criterion, when they in fact are considerably worse. (That is, pollutant concentrations are above the criterion concentration a far greater proportion of the time than specified by the water quality criterion). Conversely, use of this decision rule in concert with water quality criterion expressed as average concentrations over specific times can lead to

concluding that segment conditions are worse than water quality criterion, when in fact, they are not. If the state applies different decision rules for different types of pollutants (e.g., toxic, conventional, and non-conventional pollutants) and types of standards (e.g., acute versus chronic criteria for aquatic life or human health), the state should provide a reasonable rationale supporting the choice of a particular statistical approach to each of its different sets of pollutants and types of standards.

2. Elucidation of policy choices embedded in selection of particular statistical approaches and use of certain assumptions:

EPA strongly encourages states to highlight policy decisions implicit in the statistical analysis that they have chosen to employ in various circumstances. For example, if hypothesis testing is used, the state should make its decision-making rules transparent by explaining why it chose either "meeting Water Quality Standards" or "not meeting Water Quality Standards" as the null hypothesis (refutable presumption) as a general rule for all waters, a category of waters, or an individual segment. Starting with the assumption that a water is "healthy" when employing hypothesis testing means that a segment will be identified as impaired, and placed in Category 4 or 5, only if substantial amounts of credible evidence exist to refute the presumption. By contrast, making the null hypothesis "Water Quality Standards not being met" shifts the burden of proof to those who believe the segment is, in fact, meeting Water Quality Standards.

Which "null hypothesis" a state selects could likely create contrasting incentives regarding support for additional ambient monitoring among different stakeholders. If the null hypothesis is "meeting standards", there was no previous data on the segment, and no additional existing and readily available data and information is collected, then the "null hypothesis" cannot be rejected, and the segment would not be placed in Category 4 or 5. In this situation, those concerned about possible adverse consequences of having a segment declared "impaired" might have little interest in collection of additional ambient data. Meanwhile, users of the segment would likely want to have the segment monitored, so they can be assured that it is indeed capable of supporting the uses of concern. On the other hand, if the null hypothesis is changed to "segment not meeting Water Quality Standards": then those that would prefer that a particular segment not be labeled "impaired" would probably want more data collected, in hopes of proving that the null hypothesis is not true.

Another key policy issue in hypothesis testing is what significance level to use in deciding whether to reject the null hypothesis. Picking a high level of significance for rejecting the null hypothesis means that great emphasis is being placed on avoiding a Type I error (rejecting the null hypothesis, when in fact, the null hypothesis is true). This means that if a 0.10 significance level is chosen, the state wants to keep the chance of making a Type I error at or below 10 percent. Hence, if the chosen null hypothesis is "segment meeting Water Quality Standards", the state is trying to keep the chance of saying a segment is impaired, when in reality it is not, under 10 percent.

An additional policy issue is the Type II errors (not rejecting the null hypothesis, when it should have been). The probability of Type II errors depends on several factors. One key factor is the number of samples available. With a fixed number of samples, as the probability of Type I error decreases, the probability of a Type II error increases. States would ideally collect enough samples so the chances of making Type I and Type II errors are simultaneously small. Unfortunately, resources needed to collect those numbers of samples are quite often not available.

The final example of a policy issue that a state should describe is the rationale for concentrating limited resources to support data collection and statistical analysis in segments where there are documented water quality problems or where the combination of nonpoint source loadings and point source discharges would indicate a strong potential for a water quality problem to exist.

EPA recommends that, when picking the decision rules and statistical methods to be utilized when interpreting data and information, states attempt to minimize the chances of making either of the following two errors:

- Concluding the segment is impaired, when in fact it is not, and
- Deciding not to declare a segment impaired, when it is in fact impaired.

States should specify in their methodology what significance level they have chosen to use, in various circumstances. The methodology would best describe in "plain English" the likelihood of deciding to list a segment that in reality is not impaired (Type I error if the null hypothesis is "segment not impaired"). Also, EPA encourages states to estimate, in their assessment databases, the probability of making a Type II error (not putting on the 303(d) List a segment that in fact fails to meet Water Quality Standards), when: (1) commonly-available numbers of grab samples are available, and (2) the degree of variance in pollutant concentrations are at commonly encountered levels. For example, if an assessment is being performed with a water quality criterion (WQC) expressed as a 30-day average concentration of a certain pollutant, it would be useful to estimate the probability of a Type II error when the number of available samples over a 30-day period is equal to the average number of samples for that pollutant in segments statewide, or in a given group of segments, assuming a degree of variance in levels of the pollutant often observed over typical 30-day periods.

Appendix B
Statistical Considerations

The most recent EPA guidance on the use of statistics in the 303(d) listing methodology document is given in Appendix A. Within this guidance there are three major recommendations regarding statistics:

- Provide a description of which analytical tools the state uses under various circumstances,
- When conducting hypothesis testing, explain the various circumstances under which the burden of proof is placed on proving the water is impaired and when it is placed on proving the water is unimpaired, and
- Explain the level of statistical significance used under various circumstances.

Description of Analytical Tools

Tables B-1 and B-2 below describe the analytical tools the Department will use to determine when a water is impaired (Table B-1) or when a listed water is no longer impaired (Table B-2).

TABLE B - 1. DESCRIPTION OF ANALYTICAL TOOLS FOR DETERMINING IF WATERS ARE IMPAIRED

Designated Use	Analytes	Analytical Tool	Decision Rule/ Hypothesis	Criterion Used with the Decision Rule [23]	Significance Level
Narrative Criteria	Color (Narrative)	Hypothesis Test Two Sample, one tailed t-Test	Null Hypothesis: There is no difference in color between test stream and control stream.	Reject Null Hypothesis if calculated "t" value exceeds tabular "t" value for test alpha	0.10

[23] Where hypothesis testing is used for media other than fish tissue, for data sets with five samples or fewer, a 75 percent confidence interval around the appropriate central tendencies will be used to determine use attainment status. Use attainment will be determined as follows: (1) If the criterion value is above this interval (all values within the interval are in conformance with the criterion), rate as unimpaired; (2) If the criterion value falls within this interval, rate as unimpaired and place in Category 2B or 3B; (3) If the criterion value is below this interval (all values within the interval are not in conformance with the criterion), rate as impaired. For fish tissue, this procedure will be used with the following changes: (1) it will apply only to sample sizes of less than four and, (2) a 50% confidence interval will be used in place of the 75% confidence interval.

TABLE B - 1. DESCRIPTION OF ANALYTICAL TOOLS FOR DETERMINING IF WATERS ARE IMPAIRED

Designated Use	Analytes	Analytical Tool	Decision Rule/ Hypothesis	Criterion Used with the Decision Rule [23]	Significance Level
	Bottom deposits (Narrative)	Hypothesis Test, Two Sample, one tailed "t "Test ,- t-Test	Null Hypothesis: Solids of anthropogenic origin cover less than 20% of stream bottom where velocity is less than 0.5 feet/second.	Reject Null Hypothesis if 60% Lower Confidence Limit (LCL) of mean percent fine sediment deposition (pfsd) in stream is greater than the sum of the pfsd in the control and 20 % more of the stream bottom. i.e., where the pfsd is expressed as a decimal, test stream pfsd > (control stream pfsd)+ (0.20)[24]	0.40
Aquatic Life	Biological monitoring (Narrative)	For DNR Invert protocol: Sample sizes of 7 or less, 75% of samples must score 14 or lower. For RAM Fish IBI protocol: Sample sizes of 7 or less, 75% of samples must score less than 36.	Using DNR Invert. protocol: Null Hypothesis: Frequency of full sustaining scores for test stream is the same as for biological criteria reference streams.	Reject Null Hypothesis if frequency of fully sustaining scores on test stream is significantly less than for biological criteria reference streams.	Not Applicable

[24] If data is non-normal a nonparametric test will be used as a comparison of medians. The same 20% difference still applies. With current software the Mann-Whitney test is used.

TABLE B - 1. DESCRIPTION OF ANALYTICAL TOOLS FOR DETERMINING IF WATERS ARE IMPAIRED

Designated Use	Analytes	Analytical Tool	Decision Rule/ Hypothesis	Criterion Used with the Decision Rule [23]	Significance Level
		For DNR Invert protocol and sample size of 8 or more: Binomial Probability. For RAM Fish IBI protocol and sample size of 8 or more: Binomial Probability.	A direct comparison of frequencies between test and biological criteria reference streams will be made.	Rate as impaired if biological criteria reference stream frequency of fully biologically supporting scores is greater than five percent more than test stream.	0.1
		For other biological data: An appropriate parametric or nonparametric test will be used.	Null Hypothesis, Community metric(s) in test stream is the same as for a reference stream or control streams.	Reject Null Hypothesis If metric scores for test stream are significantly less than reference or control streams.	0.1
			Other biological monitoring to be determined by type of data.	Dependent upon available information.	Dependent upon available information.
Aquatic Life	Toxic chemicals in water. (Numeric)	Not applicable	No more than one toxic event, toxicity test failure or exceedence of acute or chronic criterion in 3 years.	Not applicable	Not applicable
	Toxic chemicals in sediments (Narrative)	Comparison of geometric mean to PEC value, or calculation of a PECQ value.	Waters are judged to be impaired if parameter geomean exceeds PEC[15], or site PECQ is exceeded.	For metals ~~except Arsenic, use 100% PEC threshold. For Arsenic,~~ use 150% of PEC threshold. The PECQ threshold value is 0.75.	Not applicable
Aquatic Life	temperature, pH, total diss. gases, oil and grease, diss. oxygen (Numeric)	Binomial probability	Null Hypothesis: No more than 10% of samples exceed the water quality criterion.	Reject Null Hypothesis if the Type I error rate is less than 0.1 .	Not applicable

TABLE B - 1. DESCRIPTION OF ANALYTICAL TOOLS FOR DETERMINING IF WATERS ARE IMPAIRED

Designated Use	Analytes	Analytical Tool	Decision Rule/ Hypothesis	Criterion Used with the Decision Rule [23]	Significance Level
Losing Streams	E.coli	Binomial probability	Null Hypothesis: No more than 10% of samples exceed the water quality criterion.	Reject Null Hypothesis if the Type I error rate is less than 0.1 .	0.10
Fish Consumption	Toxic chemicals in water (Numeric)	Hypothesis test 1-sided confidence limit	Null Hypothesis: Levels of contaminants in water do not exceed criterion.	Reject Null Hypothesis if the 60% LCL is greater than the criterion value.	0.40
Fish Consumption	Toxic chemicals in tissue (Narrative)	Four or more samples: Hypothesis test 1-sided confidence limit	Null Hypothesis: Levels in fillet samples or fish eggs do not exceed criterion.	Reject Null Hypothesis if the 60% LCL is greater than the criterion value.	0.40
Drinking Water Supply (Raw)	Toxic chemicals (Numeric)	Hypothesis test 1-sided confidence limit	Null Hypothesis: Levels of contaminants do not exceed criterion.	Reject Null Hypothesis if the 60% LCL is greater than the criterion value.	0.40
Drinking Water Supply (Raw)	Non-toxic chemicals (Numeric)	Hypothesis test 1-sided confidence limit	Null Hypothesis: Levels of contaminants do not exceed criterion.	Reject Null Hypothesis if the 60% LCL is greater than the criterion value.	0.40
Drinking Water Supply (Finished)	Toxic chemicals	Methods stipulated by Safe Drinking Water Act	Methods stipulated by Safe Drinking Water Act.	Methods stipulated by Safe Drinking Water Act.	Methods stipulated by Safe Drinking Water Act.
Whole Body Contact and Secondary Contact Rec.	Bacteria (Numeric)	Geometric mean	Null Hypothesis: Levels of contaminants do not exceed criterion.	Reject Null Hypothesis if the geometric mean is greater than the criterion value.	Not Applicable

TABLE B - 1. DESCRIPTION OF ANALYTICAL TOOLS FOR DETERMINING IF WATERS ARE IMPAIRED

Designated Use	Analytes	Analytical Tool	Decision Rule/ Hypothesis	Criterion Used with the Decision Rule [23]	Significance Level
Irrigation & Livestock Water	Toxic chemicals (Numeric)	Hypothesis test 1-Sided confidence limit	Null Hypothesis: Levels of contaminants do not exceed criterion.	Reject Null Hypothesis if the 60% LCL is greater than the criterion value.	0.40
Protection of Aquatic Life	Nutrients in lakes (Numeric)	Hypothesis test[25]	Null hypothesis: Criteria are not exceeded.	Reject Null Hypothesis if 60% LCL value is greater than criterion value.	0.40

[25] State nutrient criteria require at least four samples per year taken near the outflow point of the lake (or reservoir) between May 1 and August 31 for at least four different, not necessarily consecutive, years.

TABLE B - 2. DESCRIPTION OF ANALYTICAL TOOLS FOR DETERMINING WHEN WATERS ARE NO LONGER IMPAIRED

Designated Use	Analytes	Analytical Tool	Decision Rule/ Hypothesis	Criterion Used with the Decision Rule	Significance Level
Narrative Criteria	Color (Narrative)	Same as Table B-1	Same as Table B-1	Same as Table B-1	0.40
	Bottom deposits (Narrative)	Same as Table B-1	Same as Table B-1	Same as Table B-1	0.40
Aquatic Life	Biological monitoring (Narrative)	DNR Invert Protocol: For 7 or less samples, same as Table B-1. RAM Fish IBI Protocol: For 7 or less samples, same as Table B-1.	Same as Table B-1	Same as Table B-1	Same as Table B-1
		For DNR Invert Protocol For 8 or more samples, same as Table B-1. RAM Fish IBI Protocol: For 8 or more samples, same as Table B-1.	Same as Table B-1	Same as Table B-1	0.4
		For other biological data: Same as Table B-1.	Same as Table B-1	Same as Table B-1	0.40
	Toxic chemicals in water	Same as Table B-1	Same as Table B-1	Same as Table B-1	Same as Table B-1
	Toxic chemicals in sediments	Comparison of geomean to PEC value, or calculation of a PECQ value.	Water is judged to be unimpaired if parameter geomean is equal to or less than PEC[15], or site PECQ equaled or not exceeded.	For metals ~~except Arsenic, use 100% PEC threshold. For Arsenic,~~ use 150% of PEC threshold. The PECQ threshold value is 0.75.	Not applicable
Aquatic Life	Temperature, pH, total diss. gases, oil and grease, diss. oxygen	Same as Table B-1	Same as Table B-1	Same as Table B-1	Same as Table B-1
		Same as Table B-1	Same as Table B-1	Same as Table B-1	Same as Table B-1
Losing Streams	E. coli	Same as Table B-1	Same as Table B-1	Same as Table B-1	Same as Table B-1

TABLE B - 2. DESCRIPTION OF ANALYTICAL TOOLS FOR DETERMINING WHEN WATERS ARE NO LONGER IMPAIRED

Designated Use	Analytes	Analytical Tool	Decision Rule/ Hypothesis	Criterion Used with the Decision Rule	Significance Level
Fish Consumption	Toxic chemicals in water	Same as Table B-1	Same as Table B-1	Reject null hypothesis if the 60% UCL is greater than the criterion value.	0.40
	Toxic chemicals in tissue	Same as Table B-1	Same as Table B-1	Reject null hypothesis if the 60% UCL is greater than the criterion value.	0.40
Drinking Water Supply (Raw)	Toxic chemicals	Same as Table B-1	Same as Table B-1	Reject null hypothesis if the 60% UCL is greater than the criterion value.	0.40
Drinking Water Supply (Raw)	Non-toxic chemicals	Same as Table B-1	Same as Table B-1	Reject null hypothesis if the 60% UCL is greater than the criterion value.	0.40
Drinking Water Supply (Finished)	Toxic chemicals	Same as Table B-1	Same as Table B-1	Same as Table B-1	Same as Table B-1
Whole Body Contact and Secondary Contact Rec.	Bacteria	Same as Table B-1	Same as Table B-1	Same as Table B-1	Not applicable
Irrigation & Livestock Water	Toxic chemicals	Same as Table B-1	Same as Table B-1	Reject null hypothesis if the 60% UCL is greater than the criterion value.	0.40
Protection of Aquatic Life	Nutrients in lakes	Same as Table B-1	Same as Table B-1	Same as Table B-1	0.40

Rationale for the Burden-of-Proof

Hypothesis testing is a common statistical practice. The procedure involves first stating a hypothesis you want to test, such as "the most frequently seen color on clothing at a St. Louis Cardinals game is red" and then the opposite or null hypothesis "red is not the most frequently seen color on clothing at a Cardinals game." Then a statistical test is applied to the data (a sample of the predominant color of clothing worn by 200 fans at a Cardinals game on July 12) and based on an analysis of that data, one of the two hypotheses is chosen as correct.

In hypothesis testing, the burden-of-proof is always on the alternate hypothesis. In other words, there must be very convincing data to make us conclude that the null hypothesis is not true and that we must accept the alternate hypothesis. How convincing the data must be is stated as the "significance level" of the test. A significance level of 0.10 means that there must be at least a 90 percent probability that the alternate hypothesis is true before we can accept it and reject the null hypothesis.

For analysis of a specific kind of data, either the test significance level or the statement of null and alternative hypotheses, or both, can be varied to achieve the desired degree of statistical rigor. The Department has chosen to maintain a consistent set of null and alternate hypotheses for all our statistical procedures. The null hypothesis will be that the water body in question is unimpaired and the alternate hypothesis will be that it is impaired. Varying the level of statistical rigor will be accomplished by varying the test significance level. For determining impairment (Table B-1) test significance levels are set at either 0.1 or 0.4, meaning the data must show a 90% or 60% probability respectively, that the water body is impaired. However, if the Department retained these same test significance levels in determining when an impaired water had been restored to an unimpaired status (Table B-2) some undesirable results can occur.

For example, using a 0.1 significance level for determining both impairment and nonimpairment; if the sample data indicate the stream had a 92 percent probability of being impaired, it would be rated as impaired. If subsequent data was collected and added to the database and the data now showed the water had an 88 percent chance of being impaired, it would be rated as unimpaired. Judging as unimpaired a water with only a 12 percent probability of being unimpaired is clearly a poor decision. To correct this problem, the Department will use a test significance level of 0.4 for some analytes and 0.6 for others. This will increase our confidence in determining compliance with criteria to 40 percent and 60 percent respectively under the worst case conditions, and for most databases will provide an even higher level of confidence.

Level of Significance Used in Tests

The choice of significance levels is largely related to two concerns. The first is concern is with matching error rates with the severity of the consequences of making a decision error. The second addresses the need to balance, to the degree practicable, Type I and Type II error rates.
For relatively small databases, the disparity between Type I and Type II errors can be large. The table below shows error rates calculated using the binomial distribution for two very similar situations. Type I error rates are based on a stream with a 10 percent exceedence rate of a standard and Type II error rates for a stream with a 15 percent exceedence rate of a standard. Note that when sample size remains the same, as Type 1 error rates decrease Type II error rates increase (Table B-3). Also note that for a given Type I error rate, the Type II error rate declines as sample size increases.

Table B-3. Effects of Type I error rates on Type II error rates. Type I error rates are based on a stream with a 10 percent exceedence rate of a standard and Type II error rates for a stream with a 15 percent exceedence rate of a standard.

Total No. of Samples	No. Samples Meeting Std.	Type I Error Rate	Type II Error Rate
18	17	0.850	0.479
18	16	0.550	0.719
18	15	0.266	0.897
18	14	0.098	0.958
18	13	0.028	0.988

Table B-4. Effects of Type I error rates and sample size on Type II error rates. Type I error rates are based on a stream with a 10 percent exceedence rate of a standard and Type II error rates for a stream with a 15 percent exceedence rate of a standard.

Total No. of Samples	No. Samples Meeting Std.	Type I Error Rate	Type II Error Rate
6	5	0.469	0.953
11	9	0.303	0.930
18	15	0.266	0.897
25	21	0.236	0.836

Use of the Binomial Probability Distribution for Interpretation of the Ten Percent Rule

There are two options for assessing data for compliance with the ten percent rule. One is to simply calculate the percent of time the criterion value is not met and to judge the water to be impaired if this value is greater than ten percent. The second method is to use some evaluative procedure that can review the data and provide a probability statement regarding the compliance with the ten percent rule. Since the latter option allows assessment decisions relative to specific test significance levels and the first option does not, the latter option is preferred. The procedure chosen is the binomial probability distribution and calculation of the Type I error rate.

Other Statistical Considerations

Prior to calculation of confidence limits, the normality of the data set will be evaluated. If normality is improved by a data transformation, the confidence limits will be calculated on the transformed data.

Time of sample collection may be biased and interfere with an accurate measurement of frequency of exceedence of a criterion. Data sets composed mainly or entirely of storm water data or data collected only during a season when water quality problems are expected could result in a biased estimate of the true exceedence frequency. In these cases, the department may use methods to estimate the true annual frequency and display these calculations whenever they result in a change in the impairment status of a water.

For waters judged to be impaired based on biological data where data evaluation procedures are not specifically noted in Table 1, the statistical procedure used, test assumptions and results will be reported.

Appendix C
Examples of Statistical Procedures

Two Sample "t" Test for Color

Null Hypothesis: Amount of color is no greater in test stream than in a control stream. (As stated, this is a one-sided test, meaning that we are only interested in determining whether or not the color level in the test stream is greater than in a control stream.) If the null hypothesis had been "amount of color is different in the test and control streams" we would have been interested in determining if the amount of color was either less than or greater than the control stream, a two-sided test).

Significance Level (also known as the alpha level): 0.10

Data Set: Platinum-Cobalt color units data for the test stream and a control stream samples collected at each stream on same date.

Test Stream	70	45	35	45	60	60	80
Control Stream	50	40	20	40	30	40	75
Difference (T-C)	20	5	15	5	30	20	5

Statistics for the Difference: Mean = 14.28, standard deviation = 9.76, n = 7
Calculated "t" value = (square root of n)(mean)/standard deviation = 3.86
Tabular "t" value is taken from a table of the "t" distribution for 2 alpha (0.20) and n-1 degrees of freedom. Tabular "t" = 1.44.

Since calculated "t" value is greater than tabular t value, reject the null hypothesis and conclude that the test stream is impaired by color.

Statistical Procedure for Mercury in Fish Tissue

Data Set: data in µg/Kg 130, 230, 450. Mean = 270, Standard Deviation = 163.7
The 60% Lower Confidence Limit Interval = the sample mean minus the quantity:
((0.253)(163.7)/square root 3) = 23.9. Thus the 60% LCL Confidence Interval is 246.088 µg/Kg.

The criterion value is 300 µg/Kg. Therefore, since the 60% LCL Confidence Interval is less than the criterion value, the water is judged to be unimpaired by mercury in fish tissue, and the waterbody is placed in either Category 2B or 3B.

Appendix D

The Meaning of the Sediment Quotient and How to Calculate It

The Probable Effect Concentration (PEC) is the level of a pollutant at which harmful effects on the aquatic community are likely to be observed. While sediment criteria in the form of a PEC are given for several individual contaminants, it is recognized that when multiple contaminants occur in sediment, toxicity may occur even though the level of each individual pollutant does not reach toxic levels. The method of estimating the synergistic effects of multiple pollutants in sediments given in MacDonald *et al.* (2000) includes the calculation of a PEC Quotient. This calculation is made by dividing the pollutant concentration(s) in the sample by the PEC value for that pollutant. For single samples, the quotients are summed, and then normalized by dividing that sum by the number of pollutants in the formula. When multiple samples are available, the geomean (as calculated for specific pollutants) will be placed in the numerator position for each pollutant included in the equation.

Example: A sediment sample contains the following results in mg/kg:

Arsenic 2.5, Cadmium 4.5, Copper 17, Lead 100, Zinc 260.

The PEC values for these five pollutants in respective order are:

33, 4.98, 149, 128, 459.

PEC Quotient =

$$((2.5/(33)) + (4.5/(4.98)) + (17/(149)) + (100/(128)) + (260/(459)))/5 = 0.488$$

Using PEC Quotients to Judge Toxicity

Based on research by MacDonald *et al.* (2000) 83% of sediment samples with PEC Quotients less than 0.5 were non-toxic while 85% of sediment samples with PEC quotients greater than 0.5 were toxic. Therefore, to accurately assess the synergistic effects of sediment contaminants on aquatic life, the Department will judge PEC Quotients greater than 0.75 as toxic**.**

Appendix E

Evaluation of Biological Data

Introduction

Methods for assessing biological data typically receive considerable attention during public comment periods for the development of Listing Methodology Documents. Currently, a defined set of biocriteria are used to evaluate biological data for assessing compliance with water quality standards. These biological criteria contain numeric thresholds, that when exceeded relative to prescribed assessment methods, serve as a basis for identifying candidate waters for Section 303(d) listing. Biocriteria are based on three types of biological data, including: (1) aquatic macroinvertebrate community data; (2) fish community data; and, (3) a catch-all class referred to as "other biological data".

The purpose of this appendix is to describe the methods used to evaluate these three types of biological data. This appendix includes the following: background information on the development and scoring of biological criteria, procedures for assessing biological data, methods used to ensure sample representativeness, and additional information used to aid in assessing biological data such as the weight of evidence approach.

Aquatic Macroinvertebrate Community Data

The Department conducts aquatic macroinvertebrate bioassessments to determine macroinvertebrate community health as a function of water quality and habitat. Almost all macroinvertebrate monitoring is "targeted," where the health of the community from the "target" stream is compared to healthy macroinvertebrate communities from reference streams of the same general size and in the same ecological drainage unit (EDU).

The Department's approach to monitoring and evaluating aquatic macroinvertebrates is largely based on the document *Biological Criteria for Wadeable/Perennial Streams of Missouri* (MDNR 2002). This document provides numeric biological criteria (biocriteria) relevant to the protection of aquatic life use for wadeable streams in the state. Biocriteria were developed using wadeable reference streams that occur in specific EDUs as mapped by the Missouri Resource Assessment Partnership. For macroinvertebrates, the numeric biocriterion translator is expressed as a multiple metric index referred to as the Macroinvertebrate Stream Condition Index (MSCI). The MSCI includes four metrics: Taxa Richness (TR); Ephemeroptera, Plecoptera, and Trichoptera Taxa (EPTT); Biotic Index (BI); and the Shannon Diversity Index (SDI). These metrics are considered indicators of stream health, and change predictably in response to the environmental condition of a stream.

Metric values are determined directly from macroinvertebrate sampling. To calculate the MSCI, each metric is normalized to unitless values of 5, 3, or 1, which are then added together for a total possible score of 20. MSCI scores are divided into three levels of stream condition, Fully Biologically Supporting (16-20), Partially Biologically Supporting (10-14), and Non-Biologically Supporting (4-8). Partially and Non-Biologically Supporting streams may be considered impaired and are candidates for Section 303(d) listing.

Unitless metric values (5, 3, or 1) were developed from the lower quartile of the distribution of each metric as calculated from reference streams for each EDU. The lower quartile (25^{th} percentile) of each metric equates to the minimum value still representative of unimpaired conditions. In operational assessments, metric values below the lower quartile of reference conditions are typically judged as impaired (United States Environmental Protection Agency 1996, Ohio Environmental Protection Agency 1990, Barbour et al. 1996). Moreover, using the 25^{th} percentile of reference conditions for each metric as a standard for impairment allows natural variability to be filtered out. For metrics with values that decrease with increasing impairment (TR, EPTT, SDI), any value above the lower quartile of the reference distribution receive s a score of five. For the BI, whose value increases with increasing impairment, any va lue below the upper quartile (75^{th} percentile) of the reference distribution receives a score of five. The remainder of each metrics potential quartile range below the lower quartile is bisected, and scored either a three or a one. If the metric value is less than or equal to the quartile value and greater than the bisection value it is scored a three. If the metric value is less than or equal to the bisection value it is scored a one.

MSCI meeting data quality considerations may be assessed for the protection of aquatic life using the following procedures.

Determining Full Attainment of Aquatic Life Use:
For seven or fewer samples, 75% of the MSCI scores must be 16 or greater. Fauna achieving these scores are considered to be very similar to biocriteria reference streams.
For eight or more samples, results must be statistically similar to representative reference or control streams.

Determining Non-Attainment of Aquatic Life Use:
For seven or fewer samples, 75% of the MSCI scores must be 14 or lower. Fauna achieving these scores are considered to be substantially different from biocriteria reference streams. For eight or more samples, results must be statistically dissimilar to representative reference or control streams.

Data will be judged inconclusive when outcomes do not meet requirements for decisions of full or non-attainment.

As noted, when eight or more samples are available, results must be statistically similar or dissimilar to reference or control conditions in order to make an attainment decision. To accomplish this, a binomial probability Type I error rate is calculated based on the null hypothesis that the test stream would have a similar percentage of MSCI scores that are 16 or greater as reference streams. The significance level is set at 0.1, which is in fact the probability of committing a Type I error (rejecting a true null hypothesis). When the Type 1 error rate is less than 0.1, the null hypothesis is rejected; when the Type I error rate is greater than 0.1, the null hypothesis is accepted. For comparing samples from a test stream to samples collected from reference streams in the same EDU, the percentage of samples from reference streams scoring 16 or greater is used to determine the probability of “success” and “failure” in the binomial probability equation. For example,

if 84% of the reference stream MSCI scores in a particular EDU are 16 or greater, then 1.84 would be used as the probability of success and 0.16 would be used as the probability of failure. Note that Table B-1 states to "rate a stream as impaired if biological criteria reference stream frequency of fully biologically supporting scores is greater than five percent more than the test stream," thus, a value of 0.79 (0.84 - 0.05) would actually be used as the probability of success in the binomial distribution equation.

Binomial Probability Example:
Reference streams from the Ozark/Gasconade EDU classified as riffle/pool stream types with warm water temperature regimes produce fully biologically supporting streams 85.7% of the time. In the test stream of interest, six of 10 samples resulted in MSCI scores of 16 or more. Calculate the Type I error rate for the probability of getting six or fewer fully biologically supporting scores in 10 samples.

The binomial probability formula may be summarized as:

$$p^n + (n!/ X!(n-X)!*p^n q^{n-x}) = 1$$

Where,
Sample Size (n) = 10
Number of Successes (X) = 6
Probabilty of Success (p) = 0.857 - 0.05 = 0.807
Probability of Failure (q) = 0.193
Binomial Distribution Coefficients = n!/ X!(n-X)!

The equation may then be written as:

= 1 - ((0.807^10) + ((10*(0.807^9)*(0.193))) + ((45*(0.807^8)*(0.193^2)) + ((120*(0.807^7) * (0.193^3)))

= 0.109

Since 0.109 is greater than the test significance level (minimum allowable Type I error rate) of 0.1, we accept the null hypothesis that the test stream has the same percent of fully biologically supporting scores as the same type of reference streams from the Ozark/Gasconade EDU. Thus, this test stream would be judged as unimpaired.

If under the same scenario, there were only 5 samples from the test stream with MSCI scores of 16 or greater, the Type 1 error rate would change to 0.028, and since this value is less than the significance level of 0.1, the stream would be judged as impaired.

Within each EDU, MSCI scores are categorized by sampling regime (Glide/Pool vs. Riffle/Pool) and temperature regime (warm water vs. cold water). The percentage of fully biologically supporting scores for the Mississippi River Alluvial Basin/Black/Cache EDU is not available since there are no reference sites in this region. Percentages of fully biologically supporting samples per EDU is not included here, but can be made available upon request. The percentage of reference streams per EDU that are fully biologically supporting may change periodically as additional macroinvertebrate samples are collected and processed from reference samples in an EDU.

Sample Representativeness

DNR field and laboratory methods used to collect and process macroinvertebrate samples are contained in the document *Semi-Quantitative Macroinvertebrate Stream Bioassessment* (MDNR 2012a). Macroinvertebrates are identified to levels following standard operating procedures contained in *Taxonomic Levels for Macroinvertebrate Identifications* (MDNR 2012b). Macroinvertebrate monitoring is accompanied by physical habitat evaluations as described in the document *Stream Habitat Assessment* (MDNR 2010). For the assessment of macroinvertebrate samples, available information must be meet data code levels three and four as described in Section II.C of this LMD. Data coded as levels three and four represent environmental data providing the greatest degree of assurance. Thus, at a minimum, macroinvetebrate assessments include multiple samples from a single site, or samples from multiple sites within a single reach.

It is important to avoid situations where poor or inadequate habitat prohibits macroinverterbate communities from being assessed as fully biologically supporting. Therefore, when assessing macroinvertebrate samples, the quality of available habitat must be similar to that of reference streams within the appropriate EDU. The Department's policy for addressing this concern has been to exclude MSCI scores from an assessment when accompanying habitat scores are less than 75 percent of the mean habitat scores from reference streams of the appropriate EDU. The following procedures outline the Department's method for assessing macroinvertebrate communities from sites with poor or inadequate habitat.

Assessing Macroinvertebrate Communities from Poor/Inadequate Habitat:

-If less than half the macroinvertebrate samples in an assessed stream segment have habitat scores less than 75 percent of the mean score for reference streams in that EDU, any sample that scores less than 16 and has a habitat score less than 75 percent of the mean reference stream score for that EDU, is excluded from the assessment process.

-If at least half the macroinvertebrate samples in an assessed stream segment have habitat scores less than 75 percent of the mean score for reference streams in that EDU and the assessment results in a judgment that the invertebrate community is impaired, the assessed segment will be placed in category 4C, impairment due to poor aquatic habitat.

-If one portion of the assessment reach contains two or more samples with habitat scores less than 75 percent of reference streams from that EDU while the remaining portion does not, the portion of the stream with poor habitat scores could be separately assessed as a category 4C stream permitting low MSCI scores.

Macroinvertebrate sampling methods vary by stream type. One method is used in riffle/pool predominant streams, and the other method is for glide/pool predominant streams. For each stream type, macroinverterbate sampling targets three habitats. For riffle/pool streams, the three habitats sampled are flowing water over coarse substrate, non-flowing water over depositional substrate, and rootmat substrate. For glide/pool streams, the three habitats sampled are non-flowing water over depositional substrate, large woody debris substrate, and rootmat substrate. In some instances, one or more of the habitats sampled can be limited or missing from a stream reach, which may affect an MSCI score. Macroinvertebrate samples based on only two habitats may have a MSCI score equal to or greater than 16, but it is also possible that a missing habitat may lead to a decreased MSCI score. Although MDNR stream habitat assessment procedures take into account a number of physical habitat parameters from the sample reach (for example, riparian vegetation width, channel alteration, bank stability, bank vegetation protection, etc.), they do not exclusively measure the quality or quantity of the three predominant habitats from each stream. When evaluating potentially impaired macroinvertebrate communities, the number of habitats sampled, in addition to the stream habitat assessment score, will be considered to ensure MSCI scores less than 16 are properly attributed to poor water quality or poor/inadequate habitat condition.

Biologists responsible for conducting biological assessments will determine the extent to which habitat availability is responsible for a non-supporting (<16) MSCI score. If it is apparent that a non-supporting MSCI score was due to limited habitat, these effects will be stated in the biological assessment report. This limitation will then be considered when deciding which Listing Methodology Category is most appropriate for an individual stream. This procedure, as part of an MDNR biological assessment, will aid in determining whether impaired macroinvertebrate samples have MSCI scores based on poor water quality conditions versus habitat limitations.

To ensure assessments are based on representative macroinverterbrate samples, samples collected during or shortly after prolonged drought, shortly after major flood events, or any other conditions that fall outside the range of environmental conditions under which reference streams in the EDU were sampled, will not be used to make an attainment decision for a Section 303(d) listing or any other water quality assessment purposes. Sample "representativeness" is judged by Water Protection Program (WPP) staff after reading the biomonitoring report for that stream, and if needed, consultation with biologists from DNR's Environmental Services Program. Regarding smaller deviations from "normal" conditions, roughly 20 percent of reference samples failing to meet a fully biologically supporting MSCI score were collected following weather/climate extremes; as a result, biological criteria for a given EDU are inclusive of samples collected during not only ideal macroinvertebrate-rearing conditions, but also during the weather extremes that Missouri has to offer.

Assessing Small Streams

Occasionally, macroinvertebrate monitoring is needed to assess streams smaller than average wadeable/perennial reference streams listed in Table I of Missouri's Water Quality Standards. Smaller streams may include Class C streams (streams that may cease flow in dry periods but maintain permanent pools which support aquatic life) or those which are unclassified. Assessing small streams involves comparing test stream and candidate reference stream MSCI scores first

to, Wadeable/Perennial Reference Stream (WPRS) criteria, and second, to each other. In DNR's Biological Criteria Database, there are 16 candidate reference streams labeled as Class P, 23 labeled as Class C, and 24 labeled as Class U; and in previous work by DNR, when the MSCI was calculated according to WPRS criteria, the failure rate for such candidate reference streams was 31%, 39% and 70%, respectively. The data trend showed a higher failure rate for increasingly smaller high quality streams when scored using WPRS biological criteria. This demonstrates the need to utilize candidate reference streams in biological stream assessments.

For test streams that are smaller than wadeable perennial reference streams, DNR also samples five candidate reference streams (small control streams) of same or similar size and Valley Segment Type (VST) in the same EDU twice during the same year the test stream is sampled (additional information about the selection small control streams is provided below). Although in most cases the DNR samples small candidate reference streams concurrently with test streams, existing data may be used if a robust candidate reference stream data set exists for the EDU. If the ten small candidate reference stream scores are similar to wadeable perennial reference stream criteria, then they and the test stream are considered to have a Class C or Class P general warm water beneficial use, and the MSCI scoring system in the LMD should be used. If the small candidate reference streams have scores lower than the wadeable perennial reference streams, the assumption is that the small candidate reference streams, and the test stream, represent designated uses related to stream size that are not yet approved by EPA in the state's water quality standards. The current assessment method for test streams that are smaller than reference streams is stated below.

- If the 10 candidate reference stream (small control stream) scores are similar to WPRSs and meet LMD criteria for an unimpaired invertebrate community, then the test stream will be assessed using MSCI based procedures in the LMD.

- If the 10 candidate reference stream scores are lower than those of WPRSs and do not meet the LMD criteria for an unimpaired invertebrate community, then:

    a. The test stream will be assessed as having an unimpaired macroinvertebrate community if the test stream scores meet the LMD criteria for an unimpaired community;
    b. The test stream data will be judged inconclusive if test stream scores are similar to candidate reference stream scores;
    c. The test stream will be assessed as having a "suspect" macroinvertebrate community if its scores are slightly lower than the candidate reference streams; or,
    d. The test stream will be assessed as having an "impaired" macroinvertebrate community if its scores are much lower than the candidate reference streams.

This method of assessing small streams will be used only until such time as the aquatic habitat protection use categories based on watershed size classifications of Headwater, Creek, Small

River, Large River and Great River are ~~is~~ promulgated into Missouri water quality standards and appropriate biological metrics are established for stream size and permanence.

The approach for determining a "suspect" or "impaired" macroinvertebrate community will be made using a direct comparison between all streams being evaluated, which may include the use of percent and/or mean calculations as determined on a case by case basis. All work will be documented on the macroinvertebrate assessment worksheet and be made available during the public notice period.

Selecting Small Candidate Reference Streams

Accurately assessing streams that are smaller than reference streams begins with properly selecting small candidate reference streams. Candidate reference streams are smaller than WPRS streams and have been identified as "best available" reference stream segments in the same EDU as the test stream according to watershed, riparian and in-channel conditions. The selection of candidate reference streams is consistent with framework provided by Hughes et al. (1986) with added requirements that candidate reference streams must be from the same EDU and have the same or similar values for VST parameters. If candidate reference streams perform well when compared to WPRS, then test streams of similar size and VST are expected to do so as well. VST parameters important for selection are based on temperature, stream size, flow, geology, and relative gradient, with emphasis placed on the first three parameters.

The stepwise process for candidate reference stream selection is listed below.

1. Determine test stream reaches to be assessed.
2. Identify appropriate EDU.
3. Determine five variable VST of test stream segments (1^{st} digit = temperature; 2^{nd} digit = size; 3^{rd} digit = flow; 4^{th} digit = geology; and 5^{th} digit = relative gradient).
4. Filter all stream segments within the same EDU for the relevant five variable VSTs (1^{st} and 2^{nd} digits especially critical for small streams).
5. Filter all potential VST stream segments for stressors against available GIS layers (e.g. point source, landfills, CAFOs, lakes, reservoirs, mining, etc.).
6. Filter all potential VST stream segments against historical reports and databases.
7. Develop candidate stream list with coordinates for field verification.
8. Field verify candidate list for actual use (e.g. animal grazing, in-stream habitat, riparian habitat, representativeness, gravel mining, and other obvious human stressors).
9. Rank order candidate sites, eliminate obvious stressed sites, and select at least top five sites.
10. Calculate land use-land cover and compare to EDU.
11. Collect chemical, biological, habitat, and possibly sediment field data.

12. After multiple sampling events evaluate field data, land use, and historical data in biological assessment report.
13. If field data are satisfactory, retain candidate reference stream label in database.

Fish Community Data

The Department utilizes fish community data to determine if aquatic life use is supported in certain types of Missouri streams. When properly evaluated, fish communities serve as important indicators of stream health. In Missouri, fish communities are surveyed by the Missouri Department of Conservation (MDC). MDC selects an aquatic subregion to sample each year, and therein, surveys randomly selected streams of 2nd to 5th order in size. Fish sampling follows procedures described in the document *Resource Assessment and Monitoring Program: Standard Operational Procedures--Fish Sampling* (Combes 2011). Numeric biocriteria for fish are represented by the fish Index of Biotic Integrity (fIBI). Development of the fIBI is described in the document *Biological Criteria for Stream Fish Communities of Missouri* (Doisy et al. 2008).

The fIBI is a multi-metric index made up of nine individual metrics, which include: (1) number (#) of native individuals; (2) # of native darter species; (3) # of native benthic species; (4) # of native water column species; (5) # of native minnow species; (6) # of all native lithophilic species; (7) percentage (%) of native insectivore cyprinid individuals; (8) % of native sunfish individuals; and, (9) % of the three top dominant species. Values for each metric, as directly calculated from the fish community sample, are converted to unitless scores of 1, 3, or 5 according to criteria in Doisy et al. (2008). The fIBI is then calculated by adding these unitless values together for a total possible score of 45. Doisy et al. (2008) established an impairment threshold of 36 (where the 25th percentile of reference sites represented a score of 37), with values equal to or greater than 36 representing unimpaired communities, and values less than 36 representing impaired communities. For more information regarding fIBI scoring, please see Doisy et al. (2008).

Based on consultation between the Department and MDC, the fIBI impairment threshold value of 36 was used as the numeric biocriterion translator for making an attainment decision for aquatic life (Table 1.2 in the LMD). Work by Doisy et al. (2008) focused on streams 3rd to 5th order in size, and the fIBI was only validated for streams in the Ozark ecoregion, not for streams in the Central Plains and Mississippi Alluvial Basin. Therefore, when assessing streams with the fIBI, the index may only be applied to streams 3rd to 5th order in size from the Ozark ecoregion. Assessment procedures are outlined below.

Full Attainment

For seven or fewer samples and following MDC RAM fish community protocols, 75% of fIBI scores must be 36 or greater. Fauna achieving these scores are considered to be very similar to Ozark reference streams.

For eight or more samples, the percent of samples scoring 36 or greater must be statistically similar to representative reference or control streams. For determining this a binomial probability Type I error rate (0.1) is calculated based

on the hypothesis that the test stream would have the same percentage (75%) of fIBI scores greater than 36 as reference streams. If the Type I error rate is more than 0.1, the fish community would be rated as unimpaired.

Non-Attainment
For seven or fewer samples and following MDC RAM fish community protocols, 75 percent of the fIBI scores must be lower than 36. Fauna achieving these scores are considered to be substantially different than regional reference streams.

For eight or more samples, the percent of samples scoring 36 or less must be statistically dissimilar to representative reference or control streams. For determining this a binomial probability Type I error rate is calcualted based on the hypothesis that the test stream would have the same percentage (75%) of fIBI scores greater than 36 as reference streams. If the Type I error rate is less than 0.1, the fish community would be rated as impaired.

Data will be judged inconclusive when outcomes do not meet requirements for decisions of full or non-attainment.

With the exception of two subtle differences, use of the binomial probability for fish community samples will follow the example provided for macroinvertebrate samples in the previous section. First, instead of test stream samples being compared to reference streams of the same EDU, they will be compared to reference streams from the Ozark ecoregion. Secondly, the probability of success used in the binomial distribution equation will always be set to 0.70 since Table B-1 states to "rate a stream as impaired if biological criteria reference stream frequency of fully biologically supporting scores is greater than five percent more than the test stream."

While 1st and 2nd order stream data will not be used to judge a stream as impaired for Section 303(d) purposes, the Department may use the above assessment procedures to judge first and second order streams as unimpaired. Moreover, should samples contain fIBI scores less than 29, the Department may judge the stream as "suspected of impairment" using the above procedures.

Considerations for the Influence of Habitat Quality and Sample Representativeness
Low fIBI scores that are substantially different than reference streams could be the result of water quality problems, habitat problems, or both. When low fIBI scores are established, it is necessary to review additional information to differentiate between an impairment caused by water quality and one that is caused by habitat. The collection of a fish community sample is also accompanied by a survey of physical habitat from the sampled reach. MDC sampling protocol for stream habitat follows procedures provided by Peck et al. (2006). With MDC guidance, the Department utilizes this habitat data and other available information to assure that an assessment of aquatic life attainment based on fish data is only the result of water quality, and that an impairment resulting from habitat is categorized as such. This section describes the procedures used to assure low fIBI scores are the result of water quality problems and not habitat degradation. The below information outlines the Department's provisional method to identify unrepresentative samples and low fIBI scores with questionable habitat condition, and ensure corresponding fish IBI scores are not used for Section 303(d) listing.

A. Following recommendations from the biocriteria workgroup, the Department will consult MDC about the habitat condition of particular streams when assessing low fIBI scores.

B. Samples may be considered for Section 303(d) listing if they were collected in ONLY the Ozark ecoregion, and based upon best professional judgment from MDC Staff, the samples were collected during normal representative conditions. Samples collected from the Central Plains and Mississippi Alluvial Basin are excluded from the Section 303(d) listing.

C. Only samples from streams 3rd to 5th order in size may be considered for Section 303(d) listing. Samples from 1st or 2nd order stream sizes are excluded from Section 303(d) consideration; however, they may be placed into Categories 2B and 3B if an impairment is suspected, or into Categories 1, 2A, or 3A if sample scores indicate a stream is unimpaired. Samples from lower stream orders are surveyed under a different RAM Program protocol than 3rd to 5th order streams.

D. Samples that are ineligible for Section 303(d) listing include those collected on losing streams, as defined by the Department of Geology and Land Survey, or, collected in close proximity to losing streams. Additionally, ineligible samples may also include those collected on streams that were considered to have natural flow issues (such as substantial subsurface flow) preventing good fish IBI scores from being obtained, as determined through best professional judgment of MDC Staff.

E. Fish IBI scores must be accompanied by habitat samples with a QCPH1 habitat index score. MDC was asked to analyze meaningful habitat metrics and identify samples where habitat metrics seemed to indicate potential habitat concerns. As a result, a provisional index named QCPH1 was developed. QCPH1 values less than 0.39 indicate poor habitat, while values greater than 0.39 suggest adequate habitat is available. The QCPH1 comprises six sub-metrics indicative of substrate quality, channel disturbance, channel volume, channel spatial complexity, fish cover, and tractive force and velocity. The QCPH1 index is calculated as follows:

$$QCPH1 = ((\text{Substrate Quality} * \text{Channel Disturbance} * \text{Channel Volume} * \text{Channel Spatial Complexity} * \text{Fish Cover} * \text{Tractive Force \& Velocity})^{1/6})$$

Where sub-metrics are determined by:

Substrate Quality = ((embeddedness + small particles)/2) * ((filamentous algae + aquatic macrophyte)/2) * bedrock and hardpan

Channel Disturbance = concrete * riprap * inlet/outlet pipes * relative bed stability * residual pool observed to expected ratio

Channel Volume = ((dry substrate+width depth product + residual pool + wetted width)/4)

Channel Spatial Complexity = (coefficient of variation of mean depth + coefficient of variation of mean wetted width + fish cover variety)/3

Fish Cover = ((all natural fish cover + ((brush and overhanging vegetation + boulders + undercut bank + large woody debris)/4) + large types of fish cover)/3)

Tractive Force & Velocity = ((mean slope + depth * slope)/2)

Unimpaired fish IBI samples (fIBI ≥ 36) with QCPH1 index scores below the 0.39 threshold value, or samples without a QCPH1 score altogether, are eliminated from consideration for Category 5 and instead placed into Categories 2B or 3B should an impairment be suspected. Impaired fish communities (fIBI < 36) with QCPH1 scores < 0.39 can be placed into Category 4C (non-discrete pollutant/habitat impairment). Impaired fish communities (fIBI < 36) with adequate habitat scores (QCPH1 > 0.39) can be placed into Category 5. Appropriate streams with unimpaired fish communities and adequate habitat (QCPH1 > 0.39) may be used to judge a stream as unimpaired.

Similar to macroinvertebrates, assessment of fish community information must be based on data coded level three or four as described in Section II.C of the LMD. Data coded as levels three and four represent environmental data with the greatest degree of assurance, and thus, assessments will include multiple samples from a single site, or samples from multiple sites within a single reach.

Following the Department's provisional methodology, fish community samples available for assessment (using procedures in Table 1.2, Table B-1, and Table B-2) include only those from 3rd to 5th order Ozark Plateau streams, collected under normal, representative conditions, where habitat seemed to be good, and where there were no issues with inadequate flow or water volume.

Other Biological Data

The Department may periodically, on a case by case basis, use biological data other than MSCI or fIBI scores for assessing attainment of aquatic life. Other biological data may include information on single indicator aquatic species that are ecologically or recreationally important, or individual measures of community health that respond predictably to environmental stress. Measures of community health could be represented by aspects of structure, composition, individual health, and processes of the aquatic biota. Examples could include measures of density or diversity of aquatic organisms, replacement of pollution intolerant taxa, or even the presence of biochemical markers.

Other biological data should be collected under a well vetted study that is documented in a scientific report, a weight of evidence should be established, and the report should be referenced in the 303(d) listing worksheet. If other biological data is a critical component of the community and has been adversely affected by the presence of a pollutant or stressor, then such data would indicate a water body is impaired. The Department's use of other biological data is in agreement

with EPA's policy on independent applicability for making attainment decisions, which is intended to protect against dismissing valuable information when diagnosing an impairment of aquatic life.

The use of other biological data in waterbody assessments occurs infrequently, but when available, it is usually assessed in combination with other information collected within the waterbody of interest. The Department will avoid using other biological data as the sole justification for a Section 303(d) listing; however, other biological data will be used as part of a weight of evidence analysis for making the most informed assessment decision.

Weight of Evidence Analysis

When evaluating narrative criteria, the Department will use a weight of evidence analysis for assessing numeric translators which have not been adopted into state Water Quality Standards. Under the weight of evidence approach, all available information is examined and the greatest weight is given to data providing the "best supporting evidence" for an attainment decision. Determination of "best supporting evidence" will be made using best professional judgment, considering factors such as data quality and site-specific environmental conditions. The weight of evidence analysis will include the use of other types of environmental data when available, including fish tissue, sediment chemistry, MSCI and fIBI scores, and other biological data.

Biological data will be given greater weight in a weight of evidence analysis for making an attainment decision for aquatic life use and subsequently a Section 303(d) listing. Whether or not numeric translators of biological criteria are met is a strong indicator for the attainment of aquatic life use. Moreover, the Department retains a high degree of confidence in an attainment decision based on biological data that is representative of water quality condition.

When the weight of evidence analysis suggests, but does not provide strong, scientifically defensible evidence of impairment, the Department will place the water body in question in Categories 2B or 3B. The Department will produce a document showing all relevant data and the rationale for the attainment decision. All such documents will be made available to the public at the time of the first public notice of the proposed 303(d) list. A final recommendation on the listing of a waterbody based on narrative criteria will only be made after full consideration of all comments on the proposed list.

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Missouri Department of Natural Resources
2016 CWC Section 303(d) Listed Waters

Year	WBID	Waterbody	Cls	Imp Size	WB Size	Units	Pollutant	Source	IU	OU	U/D County	Up X	Up Y	Down X	Down Y	WBD 8	Comments
2012	2188.00	Antire Cr.	P	1.9	1.9	Mi.	Escherichia coli (W)	Urban Runoff/Storm Sewers	WBC B	AQL, IRR, LWW, SCR, HHP	St. Louis	712454	4264477	710077	4264450	07140102	1
2012	2188.00	Antire Cr.	P	1.9	1.9	Mi.	pH (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	St. Louis	712454	4264477	710077	4264450	07140102	1
2010	7627.00	August A Busch Lake No. 37	UL	30.0	30.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	GEN		St. Charles	692006	4287346	692006	4287346	07110009	1, 7
2016	**4083.00**	**Barker Creek tributary**	**C**	**1.2**	**1.2**	**Mi.**	**Oxygen, Dissolved (W)**	**Source Unknown**	**AQL**	**IRR, LWW, SCR, WBC B, HHP**	**Henry**	**449610**	**4251789**	**450292**	**4250266**	**10290108**	**1**
2012	752.00	Bass Cr.	C	4.4	4.4	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, IRR, LWW, SCR, HHP	Boone	565032	4297418	561523	4298649	10300102	1
2012	3240.00	Baynham Br.	P	4.0	4.0	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, IRR, LWW, SCR, HHP	Newton	379681	4092596	374809	4091661	11070207	1
2006	2760.00	Bee Fk.	C	1.4	8.7	Mi.	Lead (W)	Fletcher Lead Mine/Mill	AQL	CLF, IRR, LWW, SCR, WBC A, HHP	Reynolds	668683	4145627	670778	4145985	11010007	1
2014	7309.00	Bee Tree Lake	L3	10.0	10.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, IRR, LWW, SCR, WBC B	St. Louis	732843	4254646	732843	4254646	07140102	1
2014	3224.00	Beef Br.	P	2.5	2.5	Mi.	Cadmium (S)	Mill Tailings	AQL	IRR, LWW, SCR, WBC B, HHP	Newton	366623	4094312	366294	4097417	11070207	1
2014	3224.00	Beef Br.	P	2.5	2.5	Mi.	Cadmium (W)	Mill Tailings	AQL	IRR, LWW, SCR, WBC B, HHP	Newton	366623	4094312	366294	4097417	11070207	1
2014	3224.00	Beef Br.	P	2.5	2.5	Mi.	Lead (S)	Mill Tailings	AQL	IRR, LWW, SCR, WBC B, HHP	Newton	366623	4094312	366294	4097417	11070207	1
2014	3224.00	Beef Br.	P	2.5	2.5	Mi.	Zinc (S)	Mill Tailings	AQL	IRR, LWW, SCR, WBC B, HHP	Newton	366623	4094312	366294	4097417	11070207	1
2014	3224.00	Beef Br.	P	2.5	2.5	Mi.	Zinc (W)	Mill Tailings	AQL	IRR, LWW, SCR, WBC B, HHP	Newton	366623	4094312	366294	4097417	11070207	1
2006	7365.00	Belcher Branch Lake	L3	42.0	42.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, IRR, LWW, SCR, WBC B	Buchanan	351264	4382887	351264	4382887	10240012	1
2014	3980.00	Bens Branch	C	5.8	5.8	Mi.	Cadmium (S)	Oronogo/Duenweg Mining Belt	AQL	IRR, LWW, SCR, WBC B, HHP	Jasper	371061	4111567	370851	4115306	11070207	1
2014	3980.00	Bens Branch	C	5.8	5.8	Mi.	Lead (S)	Oronogo/Duenweg Mining Belt	AQL	IRR, LWW, SCR, WBC B, HHP	Jasper	371061	4111569	370856	4115293	11070207	1
2014	3980.00	Bens Branch	C	5.8	5.8	Mi.	Zinc (S)	Oronogo/Duenweg Mining Belt	AQL	IRR, LWW, SCR, WBC B, HHP	Jasper	371058	4111554	370855	4115296	11070207	1
2016	**3980.00**	**Bens Branch**	**C**	**5.8**	**5.8**	**Mi.**	**Zinc (W)**	**Oronogo/Duenweg Mining Belt**	**AQL**	**IRR, LWW, SCR, WBC B, HHP**	**Jasper**	**371058**	**4111554**	**370856**	**4115293**	**11070207**	**1**
1998	2916.00	Big Cr.	P	1.8	34.1	Mi.	Cadmium (S)	Glover smelter	AQL	CLF, IRR, LWW, SCR, WBC A, HHP	Iron	704416	4150529	704726	4147921	08020202	1
1998	2916.00	Big Cr.	P	1.8	34.1	Mi.	Lead (S)	Glover smelter	AQL	CLF, IRR, LWW, SCR, WBC A, HHP	Iron	704405	4150532	704724	4147919	08020202	1
2010	1578.00	Big Piney R.	P	4.0	7.8	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	DWS, IRR, LWW, SCR, WBC A, HHP	Texas	583132	4112464	579840	4108439	10290202	1, 5
2006	2080.00	Big R.	P	52.8	81.3	Mi.	Cadmium (S)	Old Lead Belt tailings	AQL	IND, IRR, LWW, SCR, WBC A, HHP	St. Francois/Jefferson	712112	4194396	701042	4226033	07140104	1
2010	2080.00	Big R.	P	52.3	81.3	Mi.	Lead (S)	Mill Tailings	AQL	IND, IRR, LWW, SCR, WBC A, HHP	St. Francois/Jefferson	712625	4193891	701044	4226032	07140104	1
2016	**2080.00**	**Big R.**	**P**	**81.3**	**81.3**	**Mi.**	**Lead (T)**	**Mine Tailings**	**HHP**	**AQL, IND, IRR, LWW, SCR, WBC A**	**Washington/Jefferson**	**701036**	**4226038**	**686672**	**4181275**	**07140104**	**1**
2012	111.00	Black Cr.	P	19.4	19.4	Mi.	Escherichia coli (W)	Shelbyville WWTF, Nonpoint Source	WBC B	AQL, IRR, LWW, SCR, HHP	Shelby	581883	4405278	593138	4393283	07110005	1
2006	3825.00	Black Cr.	P	1.6	1.6	Mi.	Chloride (W)	Urban Runoff/Storm Sewers	AQL	IRR, LWW, SCR, WBC B, HHP	St. Louis	731266	4278180	732023	4276834	07140101	1
2012	3825.00	Black Cr.	P	1.6	1.6	Mi.	Escherichia coli (W)	Urban Runoff/Storm Sewers	WBC B, SCR	AQL, IRR, LWW, HHP	St. Louis	731266	4278180	732023	4276834	07140101	1

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Year	WBID	Waterbody	Cls	Imp Size	WB Size	Units	Pollutant	Source	IU	OU	U/D County	Up X	Up Y	Down X	Down Y	WBD 8	Comments
2002	2769.00	Black R.	P	47.1	47.1	Mi.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, CLF, DWS, IRR, LWW, SCR, WBC A	Butler	729372	4042276	729886	4078610	11010007	1, 5
2002	2784.00	Black R.	P	39.0	39.0	Mi.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, CLF, DWS, IRR, LWW, SCR, WBC A	Wayne/Butler	729886	4078610	697890	4112203	11010007	1, 5
2006	3184.00	Blackberry Cr.	C	3.5	6.5	Mi.	Chloride (W)	Asbury Power Plant	AQL	IRR, LWW, SCR, WBC B, HHP	Jasper	360861	4132403	361580	4127893	11070207	1
2016	**3184.00**	**Blackberry Cr.**	**C**	**6.5**	**6.5**	**Mi.**	**Oxygen, Dissolved (W)**	**Ind. Point Source Discharge and NPS**	**AQL**	**IRR, LWW, SCR, WBC B, HHP**	**Jasper**	**362347**	**4123848**	**360861**	**4132404**	**11070207**	**1**
2008	3184.00	Blackberry Cr.	C	3.5	6.5	Mi.	Sulfate + Chloride	Asbury Power Plant	AQL	IRR, LWW, SCR, WBC B, HHP	Jasper	360856	4132395	361579	4127903	11070207	1
2016	**417.00**	**Blue R.**	**P**	**4.4**	**4.4**	**Mi.**	**Escherichia coli (W)**	**Urban Runoff/Storm Sewers**	**WBC B, SCR**	**AQL, IND, IRR, LWW, HHP**	**Jackson**	**373047**	**4332253**	**372990**	**4332130**	**10300101**	**1**
2016	**418.00**	**Blue R.**	**P**	**9.4**	**9.4**	**Mi.**	**Escherichia coli (W)**	**Urban Runoff/Storm Sewers**	**WBC B, SCR**	**AQL, IND, IRR, LWW, HHP**	**Jackson**	**371184**	**4329015**	**368400**	**4319633**	**10300101**	**1**
2006	419.00	Blue R.	P	7.7	7.7	Mi.	Escherichia coli (W)	Urban Runoff/Storm Sewers	WBC A	AQL, IRR, LWW, SCR, HHP	Jackson	364588	4312669	368400	4319633	10300101	1
2012	1701.00	Bonhomme Cr.	C	2.5	2.5	Mi.	Escherichia coli (W)	Urban Runoff/Storm Sewers	WBC B	AQL, IRR, LWW, SCR, HHP	St. Louis	709512	4282258	711491	4284301	10300200	1
2012	1701.00	Bonhomme Cr.	C	2.5	2.5	Mi.	pH (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	St. Louis	709512	4282258	711491	4284301	10300200	1
2006	750.00	Bonne Femme Cr.	P	7.8	7.8	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, IRR, LWW, SCR, HHP	Boone	560346	4298772	553749	4294435	10300102	1
2012	753.00	Bonne Femme Cr.	C	7.0	7.0	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, IRR, LWW, SCR, HHP	Boone	565633	4303361	560346	4298772	10300102	1
2002	2034.00	Bourbeuse R.	P	136.7	136.7	Mi.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, CLF, DWS, IRR, LWW, SCR, WBC A	Phelps/Franklin	684343	4252206	622849	4221417	07140103	1, 5
2014	7003.00	Bowling Green Lake - Old	L1	7.0	7.0	Ac.	Chlorophyll-a (W)	Rural NPS	AQL	DWS, IRR, LWW, SCR, WBC B, HHP	Pike	658498	4356565	658498	4356565	07110004	1, 4, 5
2012	7003.00	Bowling Green Lake - Old	L1	7.0	7.0	Ac.	Nitrogen, Total (W)	Rural NPS	AQL	DWS, IRR, LWW, SCR, WBC B, HHP	Pike	658497	4356565	658497	4356565	07110004	1, 4, 5
2012	7003.00	Bowling Green Lake - Old	L1	7.0	7.0	Ac.	Phosphorus, Total (W)	Rural NPS	AQL	DWS, IRR, LWW, SCR, WBC B, HHP	Pike	658502	4356562	658502	4356562	07110004	1, 4, 5
2012	1796.00	Brazeau Cr.	P	10.8	10.8	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, IRR, LWW, SCR, HHP	Perry	798229	4172491	807335	4172833	07140105	1
2002	1371.00	Brush Cr.	P	4.7	4.7	Mi.	Oxygen, Dissolved (W)	Humansville WWTP	AQL	IRR, LWW, SCR, WBC B, HHP	Polk/St. Clair	448632	4182404	444769	4187320	10290106	1
2014	3986.00	Brush Creek	C	5.4	5.4	Mi.	Chrysene, C1-C4 (S)	Nonpoint Source	AQL	IRR, LWW, SCR, WBC B, HHP	Jackson	360868	4321755	368399	4322178	10300101	1
2016	**3986.00**	**Brush Creek**	**C**	**5.4**	**5.4**	**Mi.**	**Escherichia coli (W)**	**Urban Runoff/Storm Sewers**	**WBC B**	**AQL, IRR, LWW, SCR, HHP**	**Jackson**	**360866**	**4321755**	**368394**	**4322174**	**10300101**	**1**
2016	**3986.00**	**Brush Creek**	**C**	**5.4**	**5.4**	**Mi.**	**Fluoranthene (S)**	**Nonpoint Source**	**AQL**	**IRR, LWW, SCR, WBC B, HHP**	**Jackson**	**360870**	**4321755**	**368399**	**4322178**	**10300101**	**1**
2016	**3986.00**	**Brush Creek**	**C**	**5.4**	**5.4**	**Mi.**	**Oxygen, Dissolved (W)**	**Nonpoint Source**	**AQL**	**IRR, LWW, SCR, WBC B, HHP**	**Jackson**	**360859**	**4321756**	**368396**	**4322176**	**10300101**	**1**
2014	3986.00	Brush Creek	C	5.4	5.4	Mi.	Phenanthrene (S)	Nonpoint Source	AQL	IRR, LWW, SCR, WBC B, HHP	Jackson	360869	4321755	368399	4322178	10300101	1
2014	3986.00	Brush Creek	C	5.4	5.4	Mi.	Pyrene (S)	Nonpoint Source	AQL	IRR, LWW, SCR, WBC B, HHP	Jackson	360868	4321755	368399	4322178	10300101	1
2016	**7117.00**	**Buffalo Bill Lake**	**L3**	**45.0**	**45.0**	**Ac.**	**Mercury in Fish Tissue (T)**	**Atmospheric Deposition - Toxics**	**HHP**	**AQL, IRR, LWW, SCR, WBC B**	**DeKalb**	**381664**	**4408121**	**381664**	**4408121**	**10280101**	**1**
2012	3273.00	Buffalo Cr.	P	8.0	8.0	Mi.	Fishes Bioassessments/Unknown	Source Unknown	AQL	CLF, IRR, LWW, SCR, WBC A, HHP	Newton/McDonald	369204	4075685	363942	4068061	11070208	1, 8
2006	1865.00	Burgher Br.	C	1.5	1.5	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Phelps	610212	4200283	611960	4199017	07140102	1

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Year	WBID	Waterbody	Cls	Imp Size	WB Size	Units	Pollutant	Source	IU	OU	U/D County	Up X	Up Y	Down X	Down Y	WBD 8	Comments
2006	7057.00	Busch W.A. No. 35 Lake	L3	51.0	51.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, IRR, LWW, SCR, WBC B	St. Charles	697833	4288214	697833	4288214	07110009	1
2006	3234.00	Capps Cr.	P	5.0	5.0	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, CDF, IRR, LWW, SCR, HHP	Barry/Newton	408562	4082428	402563	4083044	11070207	1
2016	**3241.00**	**Carver Br.**	**P**	**3.0**	**3.0**	**Mi.**	**Escherichia coli (W)**	**Nonpoint Source**	**WBC A**	**AQL, IRR, LWW, SCR, HHP**	**Newton**	**377023**	**4093362**	**373377**	**4092653**	**11070207**	**1**
2010	2288.00	Castor R.	P	7.5	7.5	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, IRR, LWW, SCR, HHP	Bollinger	760131	4115294	766484	4110895	07140107	1, 2
2008	737.00	Cedar Cr.	C	7.9	37.4	Mi.	Aquatic Macroinvertebrate Bioassessments/Unknown	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Boone	574525	4320028	573573	4311774	10300102	1, 8
2008	1344.00	Cedar Cr.	P	10.9	31.0	Mi.	Aquatic Macroinvertebrate Bioassessments/Unknown	Source Unknown	AQL	IRR, LWW, SCR, WBC A, HHP	Cedar	419908	4170049	422735	4179340	10290106	1, 8
2016	**1344.00**	**Cedar Cr.**	**P**	**31.0**	**31.0**	**Mi.**	**Escherichia coli (W)**	**Rural NPS**	**WBC A**	**AQL, IRR, LWW, SCR, HHP**	**Cedar**	**427580**	**4189524**	**419820**	**4170283**	**10290106**	**1**
2010	1344.00	Cedar Cr.	P	10.9	31.0	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC A, HHP	Cedar	419909	4170046	422734	4179339	10290106	1
2010	1357.00	Cedar Cr.	C	16.2	16.2	Mi.	Aquatic Macroinvertebrate Bioassessments/Unknown	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Dade/Cedar	412791	4154079	419820	4170283	10290106	1, 8
2008	1357.00	Cedar Cr.	C	16.2	16.2	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Dade/Cedar	412791	4154079	419820	4170283	10290106	1
2006	3203.00	Center Cr.	P	19.0	26.8	Mi.	Cadmium (S)	Tri-State Mining District	AQL	CLF, IND, IRR, LWW, SCR, WBC A, HHP	Jasper	377334	4111754	356381	4112856	11070207	1
2006	3203.00	Center Cr.	P	19.0	26.8	Mi.	Cadmium (W)	Tri-State Mining District	AQL	CLF, IND, IRR, LWW, SCR, WBC A, HHP	Jasper	377331	4111756	356399	4112875	11070207	1
2006	3203.00	Center Cr.	P	19.0	26.8	Mi.	Lead (S)	Tri-State Mining District	AQL	CLF, IND, IRR, LWW, SCR, WBC A, HHP	Jasper	377333	4111754	356377	4112853	11070207	1
2008	3210.00	Center Cr.	P	21.0	21.0	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, IND, IRR, LWW, SCR, HHP	Newton/Jasper	404365	4099517	383685	4107350	11070207	1
2010	3214.00	Center Cr.	P	4.9	4.9	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, CDF, IND, IRR, LWW, SCR, HHP	Lawrence/Newton	410298	4100642	404365	4099517	11070207	1
2016	**5003.00**	**Center Creek tributary**	**C**	**2.7**	**2.7**	**Mi.**	**Cadmium (W)**	**Oronogo/Dunegweg Mining Belt**	**AQL**	**IRR, LWW, SCR, WBC B, HHP**	**Jasper**	**369452**	**4117204**	**369217**	**4116017**	**11070207**	**1**
2016	**5003.00**	**Center Creek tributary**	**C**	**2.7**	**2.7**	**Mi.**	**Zinc (W)**	**Oronogo/Dunegweg Mining Belt**	**AQL**	**IRR, LWW, SCR, WBC B, HHP**	**Jasper**	**369455**	**4117204**	**369223**	**4116018**	**11070207**	**1**
2012	3963.00	Chat Creek tributary	US	0.9	0.9	Mi.	Cadmium (W)	Baldwin Park Mine	GEN		Lawrence	437560	4092547	436382	4092417	11070207	1, 7
2012	3963.00	Chat Creek tributary	US	0.9	0.9	Mi.	Zinc (W)	Baldwin Park Mine	GEN		Lawrence	437560	4092547	436382	4092415	11070207	1, 7
2014	7634.00	Chaumiere Lake	UL	3.4	3.4	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	GEN		Clay	367178	4337088	367178	4337088	10300101	1, 7
2012	1781.00	Cinque Hommes Cr.	P	17.1	17.1	Mi.	Escherichia coli (W)	Rural NPS	WBC B, SCR	AQL, IRR, LWW, HHP	Perry	793403	4183726	779350	4178434	07140105	1
2006	1333.00	Clear Cr.	P	28.2	28.2	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC A, HHP	Vernon/St. Clair	402340	4186711	417795	4205727	10290105	1
2006	1336.00	Clear Cr.	C	22.3	22.3	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Vernon	391921	4172771	402340	4186711	10290105	1
2006	3238.00	Clear Cr.	P	11.1	11.1	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, IRR, LWW, SCR, HHP	Lawrence/Newton	410980	4088931	397639	4088317	11070207	1
2002	3239.00	Clear Cr.	C	3.5	3.5	Mi.	Nutrient/Eutrophication Biol. Indicators (W)	Monett WWTP	AQL	IRR, LWW, SCR, WBC B, HHP	Barry/Lawrence	415495	4086458	410980	4088931	11070207	1, 4

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Year	WBID	Waterbody	Cls	Imp Size	WB Size	Units	Pollutant	Source	IU	OU	U/D County	Up X	Up Y	Down X	Down Y	WBD 8	Comments
2002	3239.00	Clear Cr.	C	3.5	3.5	Mi.	Oxygen, Dissolved (W)	Monett WWTP	AQL	IRR, LWW, SCR, WBC B, HHP	Barry/Lawrence	415495	4086458	410980	4088931	11070207	1
2006	935.00	Clear Fk.	P	3.1	25.8	Mi.	Oxygen, Dissolved (W)	Knob Noster WWTP, Nonpoint Source	AQL	IRR, LWW, SCR, WBC B, HHP	Johnson	448495	4291442	448650	4293696	10300104	1
2014	7326.00	Clearwater Lake	L2	1635.0	1635.0	Ac.	Chlorophyll-a (W)	Rural NPS	AQL	IRR, LWW, SCR, WBC A, HHP	Wayne/Reynolds	697891	4112203	697891	4112203	11010007	1, 4
2002	7326.00	Clearwater Lake	L2	1635.0	1635.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, IRR, LWW, SCR, WBC A	Wayne/Reynolds	697891	4112203	697891	4112203	11010007	1
2016	**7326.00**	**Clearwater Lake**	**L2**	**1635.0**	**1635.0**	**Ac.**	**Phosphorus, Total (W)**	**Nonpoint Source**	**AQL**	**IRR, LWW, SCR, WBC A, HHP**	**Wayne/Reynolds**	**697891**	**4112203**	**697891**	**4112203**	**11010007**	**1, 4**
2006	1706.00	Coldwater Cr.	C	6.9	6.9	Mi.	Chloride (W)	Urban Runoff/Storm Sewers	AQL	IND, IRR, LWW, SCR, WBC B, HHP	St. Louis	735014	4299849	741449	4301962	10300200	1
2016	**1706.00**	**Coldwater Cr.**	**C**	**6.9**	**6.9**	**Mi.**	**Escherichia coli (W)**	**Urban Runoff/Storm Sewers**	**WBC B, SCR**	**AQL, IND, IRR, LWW, HHP**	**St. Louis**	**741425**	**4301794**	**735014**	**4299849**	**10300200**	**1**
2012	2177.00	Coonville Cr.	C	1.3	1.3	Mi.	Lead (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	St. Francois	717474	4206559	716589	4204963	07140104	1
2016	**7378.00**	**Coot Lake**	**L3**	**20.0**	**20.0**	**Ac.**	**Mercury in Fish Tissue (T)**	**Atmospheric Deposition - Toxics**	**HHP**	**AQL, IRR, LWW, SCR, WBC B**	**Jackson**	**383770**	**4303154**	**383770**	**4303154**	**10290108**	**1**
2016	**7379.00**	**Cottontail Lake**	**L3**	**22.0**	**22.0**	**Ac.**	**Mercury in Fish Tissue (T)**	**Atmospheric Deposition - Toxics**	**HHP**	**AQL, IRR, LWW, SCR, WBC B**	**Jackson**	**385814**	**4304634**	**385814**	**4304634**	**10290108**	**1**
2006	1943.00	Courtois Cr.	P	2.6	32.0	Mi.	Lead (S)	Doe Run Viburnum Division Lead mine	AQL	CLF, IRR, LWW, SCR, WBC A, HHP	Washington	669868	4181478	670865	4184583	07140102	1
2006	1943.00	Courtois Cr.	P	2.6	32.0	Mi.	Zinc (S)	Doe Run Viburnum Division Lead mine	AQL	CLF, IRR, LWW, SCR, WBC A, HHP	Washington	669862	4181470	670877	4184596	07140102	1
2012	2382.00	Crane Cr.	P	13.2	13.2	Mi.	Aquatic Macroinvertebrate Bioassessments/Unknown	Source Unknown	AQL	CDF, IRR, LWW, SCR, WBC A, HHP	Stone	445954	4088238	456895	4081483	11010002	1, 8
2016	**7334.00**	**Crane Lake**	**L3**	**109.0**	**109.0**	**Ac.**	**Chlorophyll-a (W)**	**Source Unknown**	**AQL**	**IRR, LWW, SCR, WBC B, HHP**	**Iron**	**710853**	**4143902**	**710853**	**4143902**	**08020202**	**1, 4**
2016	**7334.00**	**Crane Lake**	**L3**	**109.0**	**109.0**	**Ac.**	**Phosphorus, Total (W)**	**Source Unknown**	**AQL**	**IRR, LWW, SCR, WBC B, HHP**	**Iron**	**710853**	**4143896**	**710853**	**4143896**	**08020202**	**1, 4**
2012	2816.00	Craven Ditch	C	11.6	11.6	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, HHP	Butler	730995	4068609	730730	4052473	11010007	1
2006	1703.00	Creve Coeur Cr.	C	3.8	3.8	Mi.	Chloride (W)	Urban Runoff/Storm Sewers	AQL	IRR, LWW, SCR, WBC B, HHP	St. Louis	718172	4283167	718455	4287491	10300200	1
2006	1703.00	Creve Coeur Cr.	C	3.8	3.8	Mi.	Escherichia coli (W)	Urban Runoff/Storm Sewers	WBC B	AQL, IRR, LWW, SCR, HHP	St. Louis	718172	4283167	718455	4287491	10300200	1
2006	1703.00	Creve Coeur Cr.	C	3.8	3.8	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	St. Louis	718172	4283167	718455	4287491	10300200	1
2006	1928.00	Crooked Cr.	P	3.5	3.5	Mi.	Cadmium (S)	Buick Lead Smelter	AQL	CLF, IRR, LWW, SCR, WBC A, HHP	Crawford	662216	4173989	658201	4175646	07140102	1
2006	1928.00	Crooked Cr.	P	3.5	3.5	Mi.	Cadmium (W)	Buick Lead Smelter	AQL	CLF, IRR, LWW, SCR, WBC A, HHP	Crawford	662216	4173989	658201	4175646	07140102	1
2006	1928.00	Crooked Cr.	P	3.5	3.5	Mi.	Lead (S)	Buick Lead Smelter	AQL	CLF, IRR, LWW, SCR, WBC A, HHP	Crawford	662216	4173989	658201	4175646	07140102	1
2008	3961.00	Crooked Creek	C	6.5	6.5	Mi.	Cadmium (W)	Buick Lead Smelter	GEN	AQL, IRR, LWW, SCR, WBC B, HHP	Iron/Dent	664596	4168505	662197	4173781	07140102	1, 7
2010	3961.00	Crooked Creek	C	6.5	6.5	Mi.	Copper (W)	Buick Lead Smelter	GEN	AQL, IRR, LWW, SCR, WBC B, HHP	Iron/Dent	664588	4168517	662197	4173782	07140102	1, 7
2016	**7135.00**	**Crowder St. Park Lake**	**L3**	**18.0**	**18.0**	**Ac.**	**Mercury in Fish Tissue (T)**	**Atmospheric Deposition - Toxics**	**HHP**	**AQL, IRR, LWW, SCR, WBC A**	**Grundy**	**443780**	**4438588**	**443780**	**4438588**	**10280102**	**1**
2006	2636.00	Current R.	P	124.0	124.0	Mi.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, CLF, IRR, LWW, SCR, WBC A	Shannon/Ripley	628633	4137638	696824	4041492	11010008	1
2006	219.00	Dardenne Cr.	P1	7.0	7.0	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	St. Charles	708078	4300264	713786	4304316	07110009	1

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Year	WBID	Waterbody	Cls	Imp Size	WB Size	Units	Pollutant	Source	IU	OU	U/D County	Up X	Up Y	Down X	Down Y	WBD 8	Comments
2006	3826.00	Deer Cr.	P	1.6	1.6	Mi.	Chloride (W)	Urban Runoff/Storm Sewers	AQL	IRR, LWW, SCR, WBC A, HHP	St. Louis/St. Louis City	732023	4276834	733741	4275807	07140101	1
2012	3826.00	Deer Cr.	P	1.6	1.6	Mi.	Escherichia coli (W)	Urban Runoff/Storm Sewers	WBC A, SCR	AQL, IRR, LWW, HHP	St. Louis/St. Louis City	732023	4276834	733741	4275807	07140101	1
2002	7015.00	Deer Ridge Community Lake	L3	39.0	39.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, IRR, LWW, SCR, WBC B	Lewis	599831	4448447	599831	4448447	07110002	1
2006	3109.00	Ditch #36	P	7.8	7.8	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Dunklin	770137	4018408	767863	4007224	08020204	1
2006	3810.00	Douger Br.	C	2.8	2.8	Mi.	Lead (S)	Aurora Lead Mining District	AQL	IRR, LWW, SCR, WBC B, HHP	Lawrence	432983	4092649	428971	4092384	11070207	1
2006	3810.00	Douger Br.	C	2.8	2.8	Mi.	Zinc (S)	Aurora Lead Mining District	AQL	IRR, LWW, SCR, WBC B, HHP	Lawrence	432983	4092649	428971	4092384	11070207	1
2006	1180.00	Dousinbury Cr.	P	3.9	3.9	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, IRR, LWW, SCR, HHP	Dallas	506028	4158604	501716	4160952	10290110	1
2016	**1792.00**	**Dry Fk.**	**C**	**3.2**	**3.2**	**Mi.**	**Escherichia coli (W)**	**Source Unknown**	**WBC B**	**AQL, IRR, LWW, SCR, HHP**	**Perry**	**786085**	**4185603**	**786022**	**4182315**	**07140105**	**1**
2008	3189.00	Dry Fk.	C	10.2	10.2	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, IRR, LWW, SCR, HHP	Jasper	391617	4123451	379518	4128240	11070207	1
2016	**3163.00**	**Dry Hollow**	**C**	**0.5**	**0.5**	**Mi.**	**Escherichia coli (W)**	**Source Unknown**	**SCR**	**AQL, IRR, LWW, HHP**	**Lawrence**	**413360**	**4110027**	**413000**	**4110463**	**11070207**	**1**
2006	3569.00	Dutro Carter Cr.	P	0.5	1.5	Mi.	Oxygen, Dissolved (W)	Rolla SE WWTP	AQL	IRR, LWW, SCR, WBC B, HHP	Phelps	611946	4199021	612708	4199006	07140102	1
2016	**3570.00**	**Dutro Carter Cr.**	**C**	**0.5**	**0.5**	**Mi.**	**Escherichia coli (W)**	**Source Unknown**	**WBC B, SCR**	**AQL, IRR, LWW, HHP**	**Phelps**	**610611**	**4198782**	**610120**	**4198788**	**07140102**	**1**
2016	**3199.00**	**Duval Cr.**	**C**	**7.0**	**7.0**	**Mi.**	**Escherichia coli (W)**	**Nonpoint Source**	**WBC B**	**AQL, IRR, LWW, SCR, HHP**	**Jasper**	**375229**	**4135004**	**368784**	**4127596**	**11070207**	**1**
2010	372.00	E. Fk. Crooked R.	P	19.9	19.9	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Ray	418043	4367620	423049	4349970	10300101	1
2006	457.00	E. Fk. Grand R.	P	28.7	28.7	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, DWS, IRR, LWW, SCR, HHP	Worth/Gentry	388817	4483394	384234	4450462	10280101	1, 2, 5
2008	608.00	E. Fk. Locust Cr.	P	16.7	16.7	Mi.	Escherichia coli (W)	Municipal Point Source Discharges, Nonpoint Source	WBC B	AQL, IRR, LWW, SCR, HHP	Sullivan	490788	4450893	485177	4432656	10280103	1
2008	610.00	E. Fk. Locust Cr.	C	15.7	15.7	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, IRR, LWW, SCR, HHP	Sullivan	492641	4468112	490788	4450893	10280103	1
2008	610.00	E. Fk. Locust Cr.	C	14.8	15.7	Mi.	Oxygen, Dissolved (W)	Rural NPS	AQL	IRR, LWW, SCR, WBC A, HHP	Sullivan	492629	4468112	490930	4451859	10280103	1
2006	1282.00	E. Fk. Tebo Cr.	C	10.4	14.5	Mi.	Oxygen, Dissolved (W)	Windsor SW WWTP	AQL	IRR, LWW, SCR, WBC B, HHP	Henry	453388	4263004	446906	4257222	10290108	1
1998	3964.00	East Whetstone Cr.	C	0.3	3.1	Mi.	Ammonia, Total (W)	Mountain Grove Lagoon	AQL	IRR, LWW, SCR, WBC B, HHP	Wright	564365	4111477	564856	4111385	10290201	1
2006	2166.00	Eaton Br.	C	1.2	1.2	Mi.	Cadmium (S)	Leadwood tailings pond	AQL	IRR, LWW, SCR, HHP	St. Francois	710945	4193695	712097	4194409	07140104	1
2006	2166.00	Eaton Br.	C	1.2	1.2	Mi.	Cadmium (W)	Leadwood tailings pond	AQL	IRR, LWW, SCR, HHP	St. Francois	710945	4193695	712097	4194409	07140104	1
2006	2166.00	Eaton Br.	C	1.2	1.2	Mi.	Lead (S)	Leadwood tailings pond	AQL	IRR, LWW, SCR, HHP	St. Francois	710945	4193695	712097	4194409	07140104	1
2006	2166.00	Eaton Br.	C	1.2	1.2	Mi.	Zinc (S)	Leadwood tailings pond	AQL	IRR, LWW, SCR, HHP	St. Francois	710945	4193695	712097	4194409	07140104	1
2006	2166.00	Eaton Br.	C	1.2	1.2	Mi.	Zinc (W)	Leadwood tailings pond	AQL	IRR, LWW, SCR, HHP	St. Francois	710945	4193695	712097	4194409	07140104	1
2002	2593.00	Eleven Point R.	P	22.7	22.7	Mi.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, CLF, IRR, LWW, SCR, WBC A	Oregon	663687	4040687	658823	4067446	11010011	1
2006	2597.00	Eleven Point R.	P	11.4	11.4	Mi.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, CDF, IRR, LWW, SCR, WBC A	Oregon	658823	4067446	648216	4073792	11010011	1
2008	2601.00	Eleven Point R.	P	22.3	22.3	Mi.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, CLF, IRR, LWW, SCR, WBC A	Oregon	648216	4073792	626147	4076649	11010011	1
1998	189.00	Elkhorn Cr.	C	17.6	21.4	Mi.	Oxygen, Dissolved (W)	Montgomery City East WWTF	AQL	IRR, LWW, SCR, WBC B, HHP	Montgomery	644641	4327885	631724	4317736	07110008	1
2006	1283.00	Elm Br.	C	3.0	3.0	Mi.	Oxygen, Dissolved (W)	Windsor SE WWTP	AQL	IRR, LWW, SCR, WBC B, HHP	Henry	455758	4264046	453816	4261489	10290108	1

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2012	1704.00	Fee Fee Cr. (new)	P	1.5	1.5	Mi.	Chloride (W)	Urban Runoff/Storm Sewers	AQL	IRR, LWW, SCR, WBC B, HHP	St. Louis	720613	4290506	718639	4290795	10300200	1
2012	1704.00	Fee Fee Cr. (new)	P	1.5	1.5	Mi.	Escherichia coli (W)	Urban Runoff/Storm Sewers	WBC B, SCR	AQL, IRR, LWW, HHP	St. Louis	720613	4290506	718639	4290795	10300200	1
2012	7237.00	Fellows Lake	L1	800.0	800.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, DWS, IRR, LWW, SCR, WBC A	Greene	479590	4129879	479590	4129879	10290106	1, 5
2016	**3595.00**	**Fenton Cr.**	**P**	**0.5**	**0.5**	**Mi.**	**Chloride (W)**	**Source Unknown**	**AQL**	**IRR, LWW, SCR, WBC B, HHP**	**St. Louis**	**724629**	**4265304**	**723865**	**4265429**	**07140102**	**1**
2012	3595.00	Fenton Cr.	P	0.5	0.5	Mi.	Escherichia coli (W)	Urban Runoff/Storm Sewers	WBC B	AQL, IRR, LWW, SCR, HHP	St. Louis	723865	4265429	724629	4265304	07140102	1
2012	2186.00	Fishpot Cr.	P	3.5	3.5	Mi.	Chloride (W)	Urban Runoff/Storm Sewers	AQL	IRR, LWW, SCR, WBC B, HHP	St. Louis	715611	4270777	718256	4269401	07140102	1
2008	2186.00	Fishpot Cr.	P	3.5	3.5	Mi.	Escherichia coli (W)	Urban Runoff/Storm Sewers	WBC B	AQL, IRR, LWW, SCR, HHP	St. Louis	715611	4270777	718256	4269401	07140102	1
2016	**3220.00**	**Fivemile Cr.**	**P**	**4.9**	**5.0**	**Mi.**	**Escherichia coli (W)**	**Rural NPS**	**WBC B**	**AQL, IRR, LWW, SCR, HHP**	**Newton**	**362116**	**4091122**	**355991**	**4093715**	**11070207**	**1**
2016	**864.00**	**Flat Cr.**	**P**	**23.7**	**23.7**	**Mi.**	**Mercury in Fish Tissue (T)**	**Atmospheric Deposition - Toxics**	**HHP**	**AQL, IRR, LWW, SCR, WBC B**	**Pettis/Morgan**	**504073**	**4279987**	**484807**	**4279832**	**10300103**	**1**
2006	2168.00	Flat River Cr.	C	4.7	10.0	Mi.	Cadmium (W)	Old Lead Belt tailings	AQL	IRR, LWW, SCR, WBC B, HHP	St. Francois	717605	4190862	719860	4196746	07140104	1
2010	7151.00	Forest Lake	L1	580.0	580.0	Ac.	Chlorophyll-a (W)	Rural NPS	AQL	DWS, IRR, LWW, SCR, WBC A, HHP	Adair	529118	4446686	529118	4446686	10280202	1, 4, 5
2016	**7151.00**	**Forest Lake**	**L1**	**580.0**	**580.0**	**Ac.**	**Mercury in Fish Tissue (T)**	**Atmospheric Deposition - Toxics**	**HHP**	**AQL, DWS, IRR, LWW, SCR, WBC A**	**Adair**	**529120**	**4446689**	**529120**	**4446689**	**10280202**	**1, 5**
2010	7151.00	Forest Lake	L1	580.0	580.0	Ac.	Nitrogen, Total (W)	Rural NPS	AQL	DWS, IRR, LWW, SCR, WBC A, HHP	Adair	529118	4446688	529118	4446688	10280202	1, 4, 5
2010	7151.00	Forest Lake	L1	580.0	580.0	Ac.	Phosphorus, Total (W)	Rural NPS	AQL	DWS, IRR, LWW, SCR, WBC A, HHP	Adair	529120	4446689	529120	4446689	10280202	1, 4, 5
2016	**3943.00**	**Foster Branch tributary**	**C**	**0.2**	**2.0**	**Mi.**	**Oxygen, Dissolved (W)**	**Ashland WWTF**	**AQL**	**IRR, LWW, SCR, WBC B, HHP**	**Boone**	**564696**	**4290774**	**564814**	**4290588**	**10300102**	**1**
2006	747.00	Fowler Cr.	C	6.0	6.0	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Boone	567705	4291358	568085	4285215	10300102	1
2012	1842.00	Fox Cr.	P	7.2	7.2	Mi.	Aquatic Macroinvertebrate Bioassessments/Unknown	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	St. Louis	698956	4266805	702113	4258893	07140102	1, 8
2008	38.00	Fox R.	P	42.0	42.0	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, IRR, LWW, SCR, HHP	Clark	591716	4495662	619844	4469932	07110001	1
2014	7008.00	Fox Valley Lake	L3	89.0	89.0	Ac.	Chlorophyll-a (W)	Rural NPS	AQL	IRR, LWW, SCR, WBC B, HHP	Clark	604601	4483675	604601	4483675	07110001	1, 4
2014	7008.00	Fox Valley Lake	L3	89.0	89.0	Ac.	Nitrogen, Total (W)	Rural NPS	AQL	IRR, LWW, SCR, WBC B, HHP	Clark	604599	4483679	604599	4483679	07110001	1, 4
2010	7008.00	Fox Valley Lake	L3	89.0	89.0	Ac.	Phosphorus, Total (W)	Rural NPS	AQL	IRR, LWW, SCR, WBC B, HHP	Clark	604600	4483686	604600	4483686	07110001	1, 4
2010	7382.00	Foxboro Lake	L3	22.0	22.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, IRR, LWW, SCR, WBC B	Franklin	644992	4249660	644992	4249660	07140103	1
2002	7280.00	Frisco Lake	L3	5.0	5.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, IRR, LWW, SCR, WBC B	Phelps	608326	4201524	608326	4201524	07140102	1
2016	**4061.00**	**Gailey Branch**	**C**	**3.2**	**3.2**	**Mi.**	**Oxygen, Dissolved (W)**	**Source Unknown**	**AQL**	**IRR, LWW, SCR, WBC B, HHP**	**Pike**	**653189**	**4361304**	**650012**	**4364278**	**07110007**	**1**
2012	1004.00	Gans Cr.	C	5.5	5.5	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, IRR, LWW, SCR, HHP	Boone	562859	4305362	558288	4303469	10300102	1
2002	1455.00	Gasconade R.	P	264.0	264.0	Mi.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, CLF, DWS, IRR, LWW, SCR, WBC A	Pulaski	626331	4281831	543608	4120607	10290201	1, 5

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Year	WBID	Waterbody	Cls	Imp Size	WB Size	Units	Pollutant	Source	IU	OU	U/D County	Up X	Up Y	Down X	Down Y	WBD 8	Comments
2006	2184.00	Grand Glaize Cr.	C	4.0	4.0	Mi.	Chloride (W)	Urban Runoff/Storm Sewers	AQL	IRR, LWW, SCR, WBC B, HHP	St. Louis	720447	4272244	721056	4270200	07140102	1
2008	2184.00	Grand Glaize Cr.	C	4.0	4.0	Mi.	Escherichia coli (W)	Urban Runoff/Storm Sewers	WBC B	AQL, IRR, LWW, SCR, HHP	St. Louis	720447	4272244	721056	4270200	07140102	1
2002	2184.00	Grand Glaize Cr.	C	4.0	4.0	Mi.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, IRR, LWW, SCR, WBC B	St. Louis	721056	4270200	720447	4272244	07140102	1
2006	593.00	Grand R.	P	56.0	56.0	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, DWS, IRR, LWW, SCR, HHP	Livingston/Chariton	454151	4399076	490791	4359355	10280103	1, 5
2008	1712.00	Gravois Cr.	P	2.3	2.3	Mi.	Chloride (W)	Urban Runoff/Storm Sewers	AQL	IRR, LWW, SCR, WBC B, HHP	St. Louis/St. Louis City	735408	4269269	737783	4270129	07140101	1
2006	1712.00	Gravois Cr.	P	2.3	2.3	Mi.	Escherichia coli (W)	Urban Runoff/Storm Sewers	WBC B	AQL, IRR, LWW, SCR, HHP	St. Louis/St. Louis City	735408	4269269	737783	4270129	07140101	1
2006	1713.00	Gravois Cr.	C	6.0	6.0	Mi.	Chloride (W)	Urban Runoff/Storm Sewers	AQL	IRR, LWW, SCR, WBC B, HHP	St. Louis	731101	4269870	735408	4269269	07140101	1
2006	1713.00	Gravois Cr.	C	6.0	6.0	Mi.	Escherichia coli (W)	Urban Runoff/Storm Sewers	WBC B	AQL, IRR, LWW, SCR, HHP	St. Louis	731101	4269870	735408	4269269	07140101	1
2016	**4051.00**	**Gravois Creek tributary**	**C**	**1.9**	**1.9**	**Mi.**	**Escherichia coli (W)**	**Municipal, Urbanized High Density Area, Urban Runoff/Storm Sewers**	**WBC B**	**AQL, IRR, LWW, SCR, HHP**	**St. Louis**	**727153**	**4269299**	**729316**	**4270942**	**07140101**	**1**
2006	1009.00	Grindstone Cr.	C	2.5	2.5	Mi.	Escherichia coli (W)	Rural NPS, Urban Runoff/Storm Sewers	WBC A	AQL, IRR, LWW, SCR, HHP	Boone	561330	4309115	558769	4308985	10300102	1
2014	7386.00	Harrison County Lake	L1	280.0	280.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, DWS, IRR, LWW, SCR, WBC B	Harrison	407761	4472463	407761	4472463	10280101	1, 5
2010	7152.00	Hazel Creek Lake	L1	453.0	453.0	Ac.	Chlorophyll-a (W)	Rural NPS	AQL	DWS, IRR, LWW, SCR, WBC B, HHP	Adair	531556	4461098	531556	4461098	10280201	1, 4, 5
2008	7152.00	Hazel Creek Lake	L1	453.0	453.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, DWS, IRR, LWW, SCR, WBC B	Adair	531552	4461098	531552	4461098	10280201	1, 5
2016	**2196.00**	**Headwater Div. Chan.**	**P**	**20.3**	**20.3**	**Mi.**	**Mercury in Fish Tissue (T)**	**Atmospheric Deposition - Toxics**	**HHP**	**AQL, DWS, IRR, LWW, SCR, WBC A**	**Cape Girardeau**	**809134**	**4128554**	**780746**	**4123627**	**07140107**	**1, 5**
2008	848.00	Heaths Cr.	P	21.0	21.0	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	CLF, IRR, LWW, SCR, WBC B, HHP	Pettis/Cooper	481311	4306305	498383	4308084	10300103	1
2014	596.00	Hickory Br.	C	6.8	6.8	Mi.	Oxygen, Dissolved (W)	Rural NPS	AQL	IRR, LWW, SCR, WBC B, HHP	Chariton	492740	4382070	484609	4381385	10280103	1
2006	3226.00	Hickory Cr.	P	4.9	4.9	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, IRR, LWW, SCR, HHP	Newton	381782	4079307	377855	4083987	11070207	1
2016	**1007.00**	**Hinkson Cr.**	**P**	**7.6**	**7.6**	**Mi.**	**Escherichia coli (W)**	**Nonpoint Source**	**WBC B**	**AQL, IRR, LWW, SCR, HHP**	**Boone**	**557308**	**4308963**	**550730**	**4308257**	**10300102**	**1**
2012	1008.00	Hinkson Cr.	C	18.8	18.8	Mi.	Escherichia coli (W)	Nonpoint Source	WBC A	AQL, IRR, LWW, SCR, HHP	Boone	567735	4324925	557308	4308963	10300102	1
2016	**7193.00**	**Holden City Lake**	**L1**	**290.2**	**290.2**	**Ac.**	**Mercury in Fish Tissue (T)**	**Atmospheric Deposition - Toxics**	**HHP**	**AQL, DWS, IRR, LWW, SCR, WBC B**	**Johnson**	**410151**	**4290703**	**410151**	**4290703**	**10300104**	**1, 5**
2012	1011.00	Hominy Br.	C	1.0	1.0	Mi.	Escherichia coli (W)	Rural NPS, Urban Runoff/Storm Sewers	WBC B	AQL, IRR, LWW, SCR, HHP	Boone	561244	4310832	560154	4310816	10300102	1
2010	3169.00	Honey Cr.	P	16.5	16.5	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, IRR, LWW, SCR, HHP	Lawrence	441810	4098909	423404	4104004	11070207	1
2010	3170.00	Honey Cr.	C	2.7	2.7	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, IRR, LWW, SCR, HHP	Lawrence	443610	4095816	441810	4098909	11070207	1
2010	1348.00	Horse Cr.	P	27.7	27.7	Mi.	Aquatic Macroinvertebrate Bioassessments/Unknown	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Vernon/Cedar	405029	4166750	422134	4180183	10290106	1, 8
2008	1348.00	Horse Cr.	P	27.7	27.7	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Vernon/Cedar	405029	4166750	422134	4180183	10290106	1
2014	3413.00	Horseshoe Cr.	C	5.8	5.8	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Lafayette/Jackson	404067	4315232	403598	4321954	10300101	1

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2002	7388.00	Hough Park Lake	L3	10.0	10.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, IRR, LWW, SCR, WBC B	Cole	571170	4266161	571170	4266161	10300102	1
2012	7029.00	Hunnewell Lake	L3	228.0	228.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, IRR, LWW, SCR, WBC B	Shelby	597506	4395783	597506	4395783	07110004	1
2010	420.00	Indian Cr.	C	3.4	3.4	Mi.	Chloride (W)	Road/Bridge Runoff, Non-construction	AQL	IND, IRR, LWW, SCR, WBC A, HHP	Jackson	364588	4312669	360621	4311182	10300101	1
2002	420.00	Indian Cr.	C	3.4	3.4	Mi.	Escherichia coli (W)	Leawood, KS WWTP, Urban Runoff/Storm Sewers	WBC A	AQL, IND, IRR, LWW, SCR, HHP	Jackson	360621	4311182	364588	4312669	10300101	1
2012	1946.00	Indian Cr.	P	1.9	1.9	Mi.	Lead (S)	Doe Run Viburnum Division Lead mine	AQL	IRR, LWW, SCR, WBC B, HHP	Washington	668798	4178896	669872	4181483	07140102	1
2010	1946.00	Indian Cr.	P	1.9	1.9	Mi.	Zinc (S)	Doe Run Viburnum Division Lead mine	AQL	IRR, LWW, SCR, WBC B, HHP	Washington	668798	4178896	669872	4181483	07140102	1
2006	3256.00	Indian Cr.	P	9.7	30.8	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, CLF, IRR, LWW, SCR, HHP	Newton/McDonald	390072	4072826	381952	4065143	11070208	1
2008	7389.00	Indian Creek Community Lake	L3	185.0	185.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, IRR, LWW, SCR, WBC B	Livingston	440537	4416530	440537	4416530	10280101	1
2014	3223.00	Jacobs Br.	P	1.6	1.6	Mi.	Cadmium (S)	Tri-State Mining District	AQL	IRR, LWW, SCR, WBC B, HHP	Newton	365485	4095641	365862	4097358	11070207	1
2014	3223.00	Jacobs Br.	P	1.6	1.6	Mi.	Cadmium (W)	Tri-State Mining District	AQL	IRR, LWW, SCR, WBC B, HHP	Newton	365485	4095641	365862	4097358	11070207	1
2014	3223.00	Jacobs Br.	P	1.6	1.6	Mi.	Lead (S)	Tri-State Mining District	AQL	IRR, LWW, SCR, WBC B, HHP	Newton	365485	4095641	365862	4097358	11070207	1
2014	3223.00	Jacobs Br.	P	1.6	1.6	Mi.	Zinc (S)	Tri-State Mining District	AQL	IRR, LWW, SCR, WBC B, HHP	Newton	365485	4095641	365862	4097358	11070207	1
2012	3223.00	Jacobs Br.	P	1.6	1.6	Mi.	Zinc (W)	Tri-State Mining District	AQL	IRR, LWW, SCR, WBC B, HHP	Newton	365485	4095641	365862	4097358	11070207	1
2012	3207.00	Jenkins Cr.	P	2.8	2.8	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, IRR, LWW, SCR, HHP	Jasper	389303	4103152	386194	4105401	11070207	1
2014	3208.00	Jenkins Cr.	C	4.8	4.8	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, IRR, LWW, SCR, HHP	Newton/Jasper	393119	4101129	389303	4103152	11070207	1
2012	3205.00	Jones Cr.	P	7.5	7.5	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, CLF, IRR, LWW, SCR, HHP	Newton/Jasper	388104	4099353	383685	4107350	11070207	1
2016	**5006.00**	**Joplin Creek**	**C**	**3.9**	**3.9**	**Mi.**	**Cadmium (W)**	**Mill Tailings**	**AQL**	**IRR, LWW, SCR, WBC B, HHP**	**Jasper**	**365334**	**4107354**	**364802**	**4108238**	**11070207**	**1**
2014	3374.00	Jordan Cr.	P	3.8	3.8	Mi.	Benzo-a-anthracene (S)	Urban NPS	AQL	IRR, LWW, SCR, WBC B, HHP	Greene	471023	4115738	472704	4118162	11010002	1
2014	3374.00	Jordan Cr.	P	3.8	3.8	Mi.	Benzo-a-pyrene -PAHs (S)	Urban NPS	AQL	IRR, LWW, SCR, WBC B, HHP	Greene	471023	4115738	472704	4118162	11010002	1
2014	3374.00	Jordan Cr.	P	3.8	3.8	Mi.	Chrysene, C1-C4 (S)	Urban NPS	AQL	IRR, LWW, SCR, WBC B, HHP	Greene	471023	4115738	472704	4118162	11010002	1
2016	**3374.00**	**Jordan Cr.**	**P**	**3.8**	**3.8**	**Mi.**	**Fluoranthene (S)**	**Urban NPS**	**AQL**	**IRR, LWW, SCR, WBC B, HHP**	**Greene**	**472704**	**4118162**	**471023**	**4115738**	**11010002**	**1**
2014	3374.00	Jordan Cr.	P	3.8	3.8	Mi.	Phenanthrene (S)	Urban NPS	AQL	IRR, LWW, SCR, WBC B, HHP	Greene	471023	4115738	472704	4118162	11010002	1
2014	3374.00	Jordan Cr.	P	3.8	3.8	Mi.	Pyrene (S)	Urban NPS	AQL	IRR, LWW, SCR, WBC B, HHP	Greene	471023	4115738	472704	4118162	11010002	1
2012	3592.00	Keifer Cr.	P	1.2	1.2	Mi.	Chloride (W)	Road/Bridge Runoff, Non-construction	AQL	IRR, LWW, SCR, WBC A, HHP	St. Louis	713475	4270033	714845	4269588	07140102	1
2012	3592.00	Keifer Cr.	P	1.2	1.2	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, IRR, LWW, SCR, HHP	St. Louis	713475	4270033	714845	4269588	07140102	1
2016	**7657.00**	**Knox Village Lake**	**L3**	**3.0**	**3.0**	**Ac.**	**Mercury in Fish Tissue (T)**	**Atmospheric Deposition - Toxics**	**HHP**	**AQL, IRR, LWW, SCR, WBC B**	**Jackson**	**377551**	**4309113**	**377551**	**4309113**	**10300101**	**1**
2016	**2171.00**	**Koen Cr.**	**C**	**1.0**	**1.0**	**Mi.**	**Lead (S)**	**Mine Tailings**	**AQL**	**IRR, LWW, SCR, WBC B, HHP**	**St. Francois**	**719760**	**4194283**	**720089**	**4193029**	**07140104**	**1**

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2014	1529.00	L. Beaver Cr.	C	3.5	3.5	Mi.	Escherichia coli (W)	Municipal Point Source Discharges	WBC A	AQL, IRR, LWW, SCR, HHP	Phelps	602527	4199503	600308	4195828	10290203	1
2008	1529.00	L. Beaver Cr.	C	3.5	3.5	Mi.	Sedimentation/Siltation (S)	Smith Sand and Gravel	AQL	IRR, LWW, SCR, WBC A, HHP	Phelps	602527	4199503	600308	4195828	10290203	1
2012	422.00	L. Blue R.	P	35.1	35.1	Mi.	Escherichia coli (W)	Urban Runoff/Storm Sewers	WBC B	AQL, IRR, LWW, SCR, HHP	Jackson	372712	4309259	394916	4340608	10300101	1
2012	1003.00	L. Bonne Femme Cr.	P	9.0	9.0	Mi.	Escherichia coli (W)	Source Unknown	WBC B	AQL, IRR, LWW, SCR, HHP	Boone	558288	4303469	553242	4296685	10300102	1
2006	1863.00	L. Dry Fk.	P	1.0	5.2	Mi.	Oxygen, Dissolved (W)	Rolla SE WWTP	AQL	IRR, LWW, SCR, WBC B, HHP	Phelps	613267	4199796	614362	4200448	07140102	1
2006	1864.00	L. Dry Fk.	C	0.6	4.7	Mi.	Oxygen, Dissolved (W)	Rolla SE WWTP	AQL	IRR, LWW, SCR, WBC B, HHP	Phelps	612755	4198995	613258	4199800	07140102	1
2008	1864.00	L. Dry Fk.	C	4.7	4.7	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Phelps	613005	4192818	612727	4198982	07140102	1
2006	1325.00	L. Dry Wood Cr.	P	20.5	20.5	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Vernon	376904	4174682	376740	4191482	10290104	1
2010	1326.00	L. Dry Wood Cr.	C	15.6	15.6	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Barton/Vernon	379798	4162808	376904	4174682	10290104	1
2010	3279.00	L. Lost Cr.	P	5.8	5.8	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, IRR, LWW, SCR, HHP	Newton	362556	4080613	355717	4078288	11070206	1
2006	623.00	L. Medicine Cr.	P	19.8	39.8	Mi.	Aquatic Macroinvertebrate Bioassessments/Unknown	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Mercer	463960	4492230	465770	4469240	10280103	1, 8
2006	623.00	L. Medicine Cr.	P	39.8	39.8	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, IRR, LWW, SCR, HHP	Mercer/Grundy	464025	4492224	467988	4439145	10280103	1
2004	3652.00	L. Osage R.	C	23.6	23.6	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, IRR, LWW, SCR, HHP	Vernon	358279	4206140	378073	4204995	10290103	1
2014	2854.00	L. St. Francis R.	P	24.2	32.4	Mi.	Lead (S)	Catherine Lead Mine, pos. Mine La Motte	AQL	CLF, DWS, IRR, LWW, SCR, WBC A, HHP	Madison	735771	4165598	726082	4157726	08020202	1, 5
2016	**7023.00**	**Labelle Lake #2**	**L1**	**98.0**	**98.0**	**Ac.**	**Mercury in Fish Tissue (T)**	**Atmospheric Deposition - Toxics**	**HHP**	**AQL, DWS, IRR, LWW, SCR, WBC B**	**Lewis**	**593770**	**4438441**	**593770**	**4438441**	**07110003**	**1, 5**
2016	**7659.00**	**Lake Boutin**	**L3**	**20.0**	**20.0**	**Ac.**	**Mercury in Fish Tissue (T)**	**Atmospheric Deposition - Toxics**	**HHP**	**AQL, IRR, LWW, SCR, WBC B**	**Cape Girardeau**	**810663**	**4150835**	**810663**	**4150835**	**07140105**	**1**
2002	7469.00	Lake Buteo	L3	7.0	7.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, IRR, LWW, SCR, WBC A	Johnson	449404	4289087	449404	4289087	10300104	1
2002	7436.00	Lake of the Woods	L3	3.0	3.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, IRR, LWW, SCR, WBC B	Boone	565931	4313648	565931	4313648	10300102	1
2008	7629.00	Lake of the Woods	UL	7.0	7.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	GEN		Jackson	368315	4317421	368315	4317421	10300101	1, 7
2016	**7132.00**	**Lake Paho**	**L3**	**273.0**	**273.0**	**Ac.**	**Mercury in Fish Tissue (T)**	**Atmospheric Deposition - Toxics**	**HHP**	**AQL, IRR, LWW, SCR, WBC B**	**Mercer**	**444295**	**4472261**	**444295**	**4472261**	**10280102**	**1**
2010	7054.00	Lake St. Louis	L3	444.0	444.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, IRR, LWW, SCR, WBC A	St. Charles	694062	4297112	694062	4297112	07110009	1
2014	7055.00	Lake Ste. Louise	L3	71.0	71.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, IRR, LWW, SCR, WBC A	St. Charles	691847	4296920	691847	4296920	07110009	1
2016	**7035.00**	**Lake Tom Sawyer**	**L3**	**4.0**	**4.0**	**Ac.**	**Mercury in Fish Tissue (T)**	**Atmospheric Deposition - Toxics**	**HHP**	**AQL, IRR, LWW, SCR, WBC A**	**Monroe**	**603785**	**4371568**	**603785**	**4371568**	**07110006**	**1**
2010	7212.00	Lake Winnebago	L3	272.0	272.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, IRR, LWW, SCR, WBC A	Cass	382311	4297455	382311	4297455	10290108	1
2006	847.00	Lamine R.	P	64.0	64.0	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, IRR, LWW, SCR, HHP	Morgan/Cooper	504073	4279987	513022	4314616	10300103	1
2006	3105.00	Lateral #2 Main Ditch	P	11.5	11.5	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Stoddard	774316	4075750	773639	4058046	08020204	1

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Year	WBID	Waterbody	Cls	Imp Size	WB Size	Units	Pollutant	Source	IU	OU	U/D County	Up X	Up Y	Down X	Down Y	WBD 8	Comments
2008	3105.00	Lateral #2 Main Ditch	P	11.5	11.5	Mi.	Temperature, water (W)	Channelization	AQL	IRR, LWW, SCR, WBC B, HHP	Stoddard	774316	4075750	773639	4058046	08020204	1
2012	3137.00	Lee Rowe Ditch	C	6.0	6.0	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Mississippi	824366	4076900	824243	4068035	08020201	1
2002	7020.00	Lewistown Lake	L1	35.0	35.0	Ac.	Atrazine (W)	Rural NPS	DWS	AQL, IRR, LWW, SCR, WBC B, HHP	Lewis	600676	4439291	600676	4439291	07110002	1, 2
2012	3575.00	Line Cr.	C	7.0	7.0	Mi.	Escherichia coli (W)	Urban Runoff/Storm Sewers	WBC B	AQL, IRR, LWW, SCR, HHP	Platte	358975	4343373	360133	4335563	10240011	1
2006	606.00	Locust Cr.	P	37.7	91.7	Mi.	Escherichia coli (W)	Rural NPS	WBC B, SCR	AQL, DWS, IRR, LWW, HHP	Putnam/Sullivan	488061	4492447	485932	4450780	10280103	1, 5
2012	2763.00	Logan Cr.	P	6.1	36.0	Mi.	Lead (S)	Sweetwater Lead Mine/Mill	AQL	IRR, LWW, SCR, WBC A, HHP	Reynolds	666297	4135268	666165	4127460	11010007	1
2006	696.00	Long Branch Cr.	C	1.8	14.8	Mi.	Oxygen, Dissolved (W)	Atlanta WWTP	AQL	IRR, LWW, SCR, WBC B, HHP	Macon	543323	4416546	543605	4414156	10280203	1
2002	7097.00	Longview Lake	L2	953.0	953.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, IRR, LWW, SCR, WBC A	Jackson	372710	4309263	372710	4309263	10300101	1
2006	3278.00	Lost Cr.	P	8.5	8.5	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, CLF, IRR, LWW, SCR, HHP	Newton	365739	4083856	355717	4078288	11070206	1
2010	123.00	M. Fk. Salt R.	C	11.4	25.4	Mi.	Oxygen, Dissolved (W)	Macon WWTP	AQL	IRR, LWW, SCR, WBC B, HHP	Macon	550935	4400206	554273	4390082	07110006	1
2006	2814.00	Main Ditch	C	13.0	13.0	Mi.	pH (W)	Poplar Bluff WWTP	AQL	IRR, LWW, SCR, WBC B, HHP	Butler	732529	4068029	728374	4048617	11010007	1
2006	2814.00	Main Ditch	C	13.0	13.0	Mi.	Temperature, water (W)	Channelization	AQL	IRR, LWW, SCR, WBC B, HHP	Butler	732529	4068029	728374	4048617	11010007	1
2012	1709.00	Maline Cr.	C	0.6	0.6	Mi.	Escherichia coli (W)	Urban Runoff/Storm Sewers	WBC B	AQL, IRR, LWW, SCR, HHP	St. Louis/St. Louis City	741069	4291198	741513	4290475	07140101	1
2012	3839.00	Maline Cr.	C	0.5	0.5	Mi.	Chloride (W)	Urban Runoff/Storm Sewers	AQL	IRR, LWW, SCR, HHP	St. Louis City	741513	4290475	743767	4287000	07140101	1
2016	**3839.00**	**Maline Cr.**	**C**	**0.5**	**0.5**	**Mi.**	**Escherichia coli (W)**	**Urban Runoff/Storm Sewers**	**SCR**	**AQL, IRR, LWW, HHP**	**St. Louis City**	**741513**	**4290475**	**742145**	**4290147**	**07140101**	**1**
2016	**7398.00**	**Maple Leaf Lake**	**L3**	**127.0**	**127.0**	**Ac.**	**Mercury in Fish Tissue (T)**	**Atmospheric Deposition - Toxics**	**HHP**	**AQL, IRR, LWW, SCR, WBC B**	**Lafayette**	**432403**	**4315820**	**432403**	**4315820**	**10300104**	**1**
2010	3140.00	Maple Slough	C	18.2	18.2	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Mississippi/New Madrid	820609	4090553	816878	4062805	08020201	1
2002	7033.00	Mark Twain Lake	L2	18132.0	18132.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, DWS, IRR, LWW, SCR, WBC A	Ralls	616551	4375852	616551	4375852	07110007	1, 5
2014	3596.00	Mattese Cr.	P	1.1	1.1	Mi.	Chloride (W)	Urban Runoff/Storm Sewers	AQL	IRR, LWW, SCR, WBC B, HHP	St. Louis	733139	4260643	732308	4259650	07140102	1
2014	3596.00	Mattese Cr.	P	1.1	1.1	Mi.	Escherichia coli (W)	Urban Runoff/Storm Sewers	WBC B	AQL, IRR, LWW, SCR, HHP	St. Louis	733139	4260643	732308	4259650	07140102	1
2016	**1786.00**	**McClanahan Cr.**	**C**	**2.5**	**2.5**	**Mi.**	**Escherichia coli (W)**	**Source Unknown**	**WBC B, SCR**	**AQL, IRR, LWW, HHP**	**Perry**	**783842**	**4188859**	**782791**	**4187697**	**07140105**	**1**
2016	**214.00**	**McCoy Cr.**	**C**	**4.5**	**4.5**	**Mi.**	**Oxygen, Dissolved (W)**	**Source Unknown**	**AQL**	**IRR, LWW, SCR, WBC B, HHP**	**St. Charles**	**687440**	**4304532**	**682397**	**4302617**	**07110008**	**1**
2006	619.00	Medicine Cr.	P	43.8	43.8	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, IRR, LWW, SCR, HHP	Putnam/Grundy	471740	4492250	467988	4439145	10280103	1
2016	**2183.00**	**Meramec R.**	**P**	**22.8**	**22.8**	**Mi.**	**Escherichia coli (W)**	**Source Unknown**	**WBC A**	**AQL, DWS, IND, IRR, LWW, SCR, HHP**	**St. Louis**	**718256**	**4269401**	**731939**	**4252470**	**07140102**	**1, 5**
2008	2183.00	Meramec R.	P	22.8	22.8	Mi.	Lead (S)	Old Lead belt tailings	AQL	DWS, IND, IRR, LWW, SCR, WBC A, HHP	St. Louis	718256	4269401	732150	4252184	07140102	1, 5
2008	2185.00	Meramec R.	P	15.7	15.7	Mi.	Lead (S)	Old Lead Belt tailings	AQL	CLF, DWS, IND, IRR, LWW, SCR, WBC A, HHP	Jefferson/St. Louis	707821	4260833	718256	4269401	07140102	1, 5
1994	1299.00	Miami Cr.	P	19.6	19.6	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Bates	372360	4240637	383003	4222753	10290102	1
2006	468.00	Middle Fk. Grand R.	P	27.5	27.5	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, IRR, LWW, SCR, HHP	Worth/Gentry	385572	4488578	381803	4452419	10280101	1

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2010	3262.00	Middle Indian Cr.	C	3.5	3.5	Mi.	Aquatic Macroinvertebrate Bioassessments/Unknown	Source Unknown	AQL	IRR, LWW, SCR, WBC A, HHP	Newton	400092	4074869	395454	4074061	11070208	1, 8
2010	3263.00	Middle Indian Cr.	P	2.2	2.2	Mi.	Aquatic Macroinvertebrate Bioassessments/Unknown	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Newton	395454	4074061	392652	4075387	11070208	1, 8
2008	3263.00	Middle Indian Cr.	P	2.2	2.2	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, IRR, LWW, SCR, HHP	Newton	395454	4074061	392652	4075387	11070208	1
2016	**4066.00**	**Mill Creek**	**C**	**3.4**	**3.4**	**Mi.**	**Escherichia coli (W)**	**Urban Runoff/Storm Sewers**	**WBC B, SCR**	**AQL, IRR, LWW, HHP**	**Jackson**	**363936**	**4318005**	**366400**	**4322065**	**10300101**	**1**
2016	**4066.00**	**Mill Creek**	**C**	**3.4**	**3.4**	**Mi.**	**Oxygen, Dissolved (W)**	**Urban Runoff/Storm Sewers**	**AQL**	**IRR, LWW, SCR, WBC B, HHP**	**Jackson**	**363935**	**4318002**	**366400**	**4322065**	**10300101**	**1**
2014	1707.03	Mississippi R.	P	44.6	44.6	Mi.	Escherichia coli (W)	Municipal Point Source Discharges, Nonpoint Source	WBC B	AQL, DWS, IND, IRR, LWW, SCR, HHP	St. Louis/Ste. Genevieve	732150	4252184	769132	4207187	07140101	1, 5
2010	226.00	Missouri R.	P	184.5	184.5	Mi.	Escherichia coli (W)	Municipal Point Source Discharges, Nonpoint Source	WBC B	AQL, DWS, IND, IRR, LWW, SCR, HHP	Atchison/Jackson	265899	4496416	361019	4330707	10240001	1, 5
2012	356.00	Missouri R.	P	129.0	129.0	Mi.	Escherichia coli (W)	Municipal Point Source Discharges, Nonpoint Source	WBC B, SCR	AQL, DWS, IND, IRR, LWW, HHP	Jackson/Chariton	361019	4330707	503487	4351401	10300101	1, 5
2008	1604.00	Missouri R.	P	33.9	104.5	Mi.	Escherichia coli (W)	Municipal Point Source Discharges, Nonpoint Source	WBC B	AQL, DWS, IND, IRR, LWW, SCR, HHP	St. Charles/St. Louis	714448	4289612	750286	4299158	10300200	1, 5
2014	7031.00	Monroe City Lake	L1	94.0	94.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, DWS, IRR, LWW, SCR, WBC A	Ralls	614620	4384921	614620	4384921	07110007	1, 5
2016	**7301.00**	**Monsanto Lake**	**L3**	**18.0**	**18.0**	**Ac.**	**Nitrogen, Total (W)**	**Source Unknown**	**AQL**	**IRR, LWW, SCR, WBC A, HHP**	**St. Francois**	**719988**	**4187888**	**719988**	**4187888**	**07140104**	**1, 4, 6**
2010	7402.00	Mozingo Lake	L1	898.0	898.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, DWS, IRR, LWW, SCR, WBC B	Nodaway	348761	4467999	348761	4467999	10240013	1, 5
2008	853.00	Muddy Cr.	P	62.2	62.2	Mi.	Aquatic Macroinvertebrate Bioassessments/Unknown	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Pettis	458149	4281754	495127	4299752	10300103	1, 8
2006	674.00	Mussel Fk.	C	29.0	29.0	Mi.	Escherichia coli (W)	Rural NPS	WBC B, SCR	AQL, DWS, IRR, LWW, HHP	Sullivan/Macon	509539	4450637	513872	4410410	10280202	1, 5
2016	**158.00**	**N. Fk. Cuivre R.**	**P**	**25.1**	**25.1**	**Mi.**	**Escherichia coli (W)**	**Rural NPS**	**WBC A**	**AQL, IRR, LWW, SCR, HHP**	**Pike/Lincoln**	**673823**	**4320571**	**656791**	**4337025**	**07110008**	**1**
2008	170.00	N. Fk. Cuivre R.	C	10.0	10.0	Mi.	Escherichia coli (W)	Source Unknown	WBC B	AQL, IRR, LWW, SCR, HHP	Pike	656791	4337025	651658	4345253	07110008	1, 2
2008	3186.00	N. Fk. Spring R.	P	17.4	17.4	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, IRR, LWW, SCR, HHP	Jasper	379518	4128240	363884	4125753	11070207	1
2006	3188.00	N. Fk. Spring R.	C	1.1	55.9	Mi.	Ammonia, Total (W)	Lamar WWTP	AQL	IRR, LWW, SCR, WBC B, HHP	Barton	386254	4148800	386721	4148123	11070207	1
2008	3188.00	N. Fk. Spring R.	C	55.9	55.9	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, IRR, LWW, SCR, HHP	Dade/Jasper	408705	4131497	379518	4128240	11070207	1
2006	3188.00	N. Fk. Spring R.	C	55.9	55.9	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Dade/Jasper	408705	4131497	379518	4128240	11070207	1
2012	3260.00	N. Indian Cr.	P	5.2	5.2	Mi.	Aquatic Macroinvertebrate Bioassessments/Unknown	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Newton	395488	4077540	390081	4072821	11070208	1, 8
2008	3260.00	N. Indian Cr.	P	5.2	5.2	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, IRR, LWW, SCR, HHP	Newton	395488	4077540	390081	4072821	11070208	1
2006	1170.00	Niangua R.	P	56.0	56.0	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, CLF, IRR, LWW, SCR, HHP	Webster/Dallas	507117	4144345	512225	4176338	10290110	1

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2014	227.00	Nishnabotna R.	P	10.2	10.2	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, DWS, IRR, LWW, SCR, HHP	Atchison	276742	4495889	271481	4484915	10240004	1, 5
2006	550.00	No Cr.	P	28.7	28.7	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, IRR, LWW, SCR, HHP	Grundy/Livingston	461790	4446877	451131	4415226	10280102	1
2010	550.00	No Cr.	P	28.7	28.7	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Grundy/Livingston	461790	4446877	451131	4415226	10280102	1
2014	7316.00	Noblett Lake	L3	26.0	26.0	Ac.	Chlorophyll-a (W)	Nonpoint Source	AQL	IRR, LWW, SCR, WBC A, HHP	Douglas	579888	4085045	579888	4085045	11010006	1, 4
2002	7316.00	Noblett Lake	L3	26.0	26.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, IRR, LWW, SCR, WBC A	Douglas	579874	4085060	579874	4085060	11010006	1
2014	7316.00	Noblett Lake	L3	26.0	26.0	Ac.	Phosphorus, Total (W)	Nonpoint Source	AQL	IRR, LWW, SCR, WBC A, HHP	Douglas	579889	4085046	579889	4085046	11010006	1, 4
2010	279.00	Nodaway R.	P	59.3	59.3	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, IRR, LWW, SCR, HHP	Nodaway/Andrew	328881	4493666	331916	4418596	10240010	1
2016	**7317.00**	**Norfork Lake**	**L2**	**1000.0**	**1000.0**	**Ac.**	**Mercury in Fish Tissue (T)**	**Atmospheric Deposition - Toxics**	**HHP**	**AQL, IRR, LWW, SCR, WBC A**	**Ozark**	**566331**	**4039451**	**566331**	**4039451**	**11010006**	**1**
2010	7109.00	North Bethany City Reservoir	L3	78.0	78.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, IRR, LWW, SCR, WBC A	Harrison	412395	4463013	412395	4463013	10280101	1
2014	3811.00	North Branch Wilsons Cr.	P	3.8	3.8	Mi.	Zinc (S)	Urban NPS	AQL	IRR, LWW, SCR, WBC B, HHP	Greene	468778	4116745	469345	4119828	11010002	1
2016	**1794.00**	**Omete Cr.**	**C**	**1.2**	**1.2**	**Mi.**	**Escherichia coli (W)**	**Source Unknown**	**WBC B, SCR**	**AQL, IRR, LWW, HHP**	**Perry**	**791333**	**4181836**	**791241**	**4180095**	**07140105**	**1**
2016	**1293.00**	**Osage R.**	**P**	**50.7**	**50.7**	**Mi.**	**Escherichia coli (W)**	**Source Unknown**	**WBC A**	**AQL, IRR, LWW, SCR, HHP**	**Vernon/St. Clair**	**436430**	**4210316**	**390841**	**4209576**	**10290105**	**1**
2010	1293.00	Osage R.	P	50.7	50.7	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC A, HHP	Vernon/St. Clair	436430	4210316	390841	4209576	10290105	1
2016	**7441.00**	**Palmer Lake**	**L3**	**102.0**	**102.0**	**Ac.**	**Mercury in Fish Tissue (T)**	**Atmospheric Deposition - Toxics**	**HHP**	**AQL, IRR, LWW, SCR, WBC A**	**Washington**	**682914**	**4188125**	**682914**	**4188125**	**07140102**	**1**
2006	1373.00	Panther Cr.	C	9.7	9.7	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Polk/St. Clair	453742	4183206	444279	4187593	10290106	1
2008	2373.00	Pearson Cr.	P	8.0	8.0	Mi.	Aquatic Macroinvertebrate Bioassessments/Unknown	Source Unknown	AQL	IRR, LWW, SCR, WBC A, HHP	Greene	482571	4113045	486612	4121328	11010002	1, 8
2006	2373.00	Pearson Cr.	P	8.0	8.0	Mi.	Escherichia coli (W)	Rural NPS, Urban Runoff/Storm Sewers	WBC A	AQL, IRR, LWW, SCR, HHP	Greene	486612	4121328	482571	4113045	11010002	1
2016	**99.00**	**Peno Cr.**	**C**	**14.4**	**14.4**	**Mi.**	**Oxygen, Dissolved (W)**	**Northeast Correctional Center WWTP, Source Unknown**	**AQL**	**CLF, IRR, LWW, SCR, WBC B, HHP**	**Pike**	**648754**	**4377841**	**649992**	**4364284**	**07110007**	**1**
2016	**7273.00**	**Perry County Community Lake**	**L3**	**89.0**	**89.0**	**Ac.**	**Mercury in Fish Tissue (T)**	**Atmospheric Deposition - Toxics**	**HHP**	**AQL, IRR, LWW, SCR, WBC B**	**Perry**	**771936**	**4179754**	**771936**	**4179754**	**07140105**	**1**
2008	7628.00	Perry Phillips Lake	UL	32.0	32.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	GEN		Boone	561236	4305581	561236	4305581	10300102	1, 7
2012	215.00	Peruque Cr.	P1	9.6	9.6	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	St. Charles	700317	4301742	705352	4308025	07110009	1
2002	217.00	Peruque Cr.	P	4.0	4.0	Mi.	Fishes Bioassessments/Unknown	Nonpoint Source	AQL	IRR, LWW, SCR, WBC B, HHP	St. Charles	686322	4296816	690798	4295430	07110009	1, 8
2002	218.00	Peruque Cr.	C	10.9	10.9	Mi.	Fishes Bioassessments/Unknown	Nonpoint Source	AQL	IRR, LWW, SCR, WBC B, HHP	Warren/St. Charles	674302	4297979	686322	4296816	07110009	1, 8
2016	**218.00**	**Peruque Cr.**	**C**	**10.9**	**10.9**	**Mi.**	**Oxygen, Dissolved (W)**	**Source Unknown**	**AQL**	**IRR, LWW, SCR, WBC B, HHP**	**Warren/St. Charles**	**686322**	**4296816**	**674302**	**4297979**	**07110009**	**1**
2010	2815.00	Pike Cr.	C	6.0	6.0	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, HHP	Butler	727556	4074154	732529	4068029	11010007	1
2010	312.00	Platte R.	P	142.4	142.4	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, DWS, IRR, LWW, SCR, HHP	Worth/Platte	370620	4492569	341432	4347540	10240012	1, 5

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2012	1327.00	Pleasant Run Cr.	C	7.6	7.6	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Vernon	381362	4169529	376904	4174682	10290104	1
2006	3120.00	Pole Cat Slough	P	12.6	12.6	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Dunklin	763796	4013691	755748	3998563	08020204	1
2014	3120.00	Pole Cat Slough	P	12.6	12.6	Mi.	Temperature, water (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Dunklin	763796	4013691	755748	3998563	08020204	1
2014	1440.00	Pomme de Terre R.	P	69.1	69.1	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, IRR, LWW, SCR, HHP	Webster/Polk	506083	4131874	465307	4180755	10290107	1
2006	2038.00	Red Oak Cr.	C	10.1	10.0	Mi.	Oxygen, Dissolved (W)	Owensville WWTP	AQL	IRR, LWW, SCR, WBC B, HHP	Gasconade	631423	4239850	642015	4246717	07140103	1
2016	**7204.00**	**Rinquelin Trail Community Lake**	**L3**	**27.0**	**27.0**	**Ac.**	**Mercury in Fish Tissue (T)**	**Atmospheric Deposition - Toxics**	**HHP**	**AQL, IRR, LWW, SCR, WBC B**	**Maries**	**574600**	**4215520**	**574600**	**4215520**	**10290111**	**1**
2006	1710.00	River des Peres	P	2.6	2.6	Mi.	Chloride (W)	Urban Runoff/Storm Sewers	AQL	IRR, LWW, SCR, HHP	St. Louis City	738751	4268514	736562	4271521	07140101	1
2012	1710.00	River des Peres	P	2.6	2.6	Mi.	Escherichia coli (W)	Urban Runoff/Storm Sewers	SCR	AQL, IRR, LWW, HHP	St. Louis City	738751	4268514	736562	4271521	07140101	1
2010	1710.00	River des Peres	P	2.6	2.6	Mi.	Oxygen, Dissolved (W)	Urban Runoff/Storm Sewers	AQL	IRR, LWW, SCR, HHP	St. Louis City	738751	4268514	736562	4271521	07140101	1
2006	3972.00	River des Peres	C	13.6	13.6	Mi.	Chloride (W)	Urban Runoff/Storm Sewers	AQL	IRR, LWW, SCR, WBC B, HHP	St. Louis	731228	4283838	734090	4282681	07140101	1
2016	**3972.00**	**River des Peres**	**C**	**13.6**	**13.6**	**Mi.**	**Escherichia coli (W)**	**Urban Runoff/Storm Sewers**	**WBC B, SCR**	**AQL, IRR, LWW, HHP**	**St. Louis**	**731230**	**4283832**	**734091**	**4282681**	**07140101**	**1**
2006	655.00	S. Blackbird Cr.	C	13.0	13.0	Mi.	Ammonia, Total (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Putnam	503682	4475363	518712	4469745	10280201	1
1994	142.00	S. Fk. Salt R.	C	20.1	40.1	Mi.	Oxygen, Dissolved (W)	Mexico WWTP, Rural Nonpoint Source	AQL	IRR, LWW, SCR, WBC B, HHP	Callaway/Audrain	600364	4322884	596694	4341638	07110006	1
2006	1249.00	S. Grand R.	P	66.8	66.8	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, IRR, LWW, SCR, HHP	Cass/Henry	366728	4281000	429978	4242884	10290108	1
2012	3259.00	S. Indian Cr.	P	8.7	8.7	Mi.	Aquatic Macroinvertebrate Bioassessments/Unknown	Source Unknown	AQL	CDF, IRR, LWW, SCR, WBC B, HHP	McDonald/Newton	399208	4067538	390081	4072821	11070208	1, 8
2008	3259.00	S. Indian Cr.	P	8.7	8.7	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, CDF, IRR, LWW, SCR, HHP	McDonald/Newton	399208	4067538	390081	4072821	11070208	1
2010	594.00	Salt Cr.	C	14.9	14.9	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Chariton	491540	4377934	485852	4365132	10280103	1
2014	893.00	Salt Fk.	P	13.3	26.7	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Saline	472648	4336520	486215	4328728	10300104	1
2012	2113.00	Salt Pine Cr.	C	1.2	1.2	Mi.	Aquatic Macroinvertebrate Bioassessments/Unknown	Barite tailings pond	AQL	IRR, LWW, SCR, WBC B, HHP	Washington	698656	4214467	697844	4216050	07140104	1, 8
2008	91.00	Salt R.	P	29.0	29.0	Mi.	Oxygen, Dissolved (W)	Mark Twain Lake re-regulation dam	AQL	DWS, IRR, LWW, SCR, WBC A, HHP	Ralls/Pike	622770	4380470	654484	4376225	07110007	1, 5
2012	103.00	Salt R.	P1	9.3	9.3	Mi.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, DWS, IRR, LWW, SCR, WBC A	Ralls	622770	4380470	616554	4375853	07110007	1, 5
2014	103.00	Salt R.	P1	9.3	9.3	Mi.	Oxygen, Dissolved (W)	Cannon Dam	AQL	DWS, IRR, LWW, SCR, WBC A, HHP	Ralls	616554	4375853	622770	4380500	07110007	1, 5
2014	2119.00	Shibboleth Br.	P	1.0	1.0	Mi.	Lead (S)	Mill Tailings	AQL	IRR, LWW, SCR, WBC B, HHP	Washington	705148	4210760	706311	4210501	07140104	1
2014	2119.00	Shibboleth Br.	P	1.0	1.0	Mi.	Zinc (S)	Mill Tailings	AQL	IRR, LWW, SCR, WBC B, HHP	Washington	705148	4210760	706311	4210501	07140104	1
2014	3222.00	Shoal Cr.	P	3.8	50.5	Mi.	Zinc (S)	Mill Tailings	AQL	CLF, DWS, IND, IRR, LWW, SCR, WBC A, HHP	Newton	360972	4100172	356106	4099741	11070207	1, 5
2014	3754.00	Slater Br.	C	3.7	3.7	Mi.	Escherichia coli (W)	Nonpoint Source	WBC B	AQL, IRR, LWW, SCR, HHP	Jasper	372935	4129976	369417	4127684	11070207	1
2006	399.00	Sni-a-bar Cr.	P	36.6	36.6	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Jackson/Lafayette	398859	4311016	416463	4333103	10300101	1

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Year	WBID	Waterbody	Cls	Imp Size	WB Size	Units	Pollutant	Source	IU	OU	U/D County	Up X	Up Y	Down X	Down Y	WBD 8	Comments
2012	224.00	Spencer Cr.	C	1.5	1.5	Mi.	Chloride (W)	Road/Bridge Runoff, Non-construction	AQL	IRR, LWW, SCR, HHP	St. Charles	708205	4298105	709432	4300121	07110009	1
2016	**5007.00**	**Spring Branch**	**C**	**1.4**	**3.1**	**Mi.**	**Escherichia coli (W)**	**Source Unknown**	**WBC B**	**AQL, IRR, LWW, SCR, HHP**	**St. Louis**	**711579**	**4270614**	**713449**	**4270031**	**07140102**	**1**
2006	3160.00	Spring R.	P	61.7	61.7	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, CLF, IND, IRR, LWW, SCR, HHP	Lawrence/Jasper	420405	4108691	356380	4117694	11070207	1
2010	3164.00	Spring R.	P	8.8	8.8	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, CDF, IND, IRR, LWW, SCR, HHP	Lawrence	425936	4100897	420405	4108691	11070207	1
2010	3165.00	Spring R.	P	11.9	11.9	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, IRR, LWW, SCR, HHP	Lawrence	430983	4088423	425936	4100897	11070207	1
2012	2835.00	St. Francis R.	P	8.4	93.1	Mi.	Temperature, water (W)	Source Unknown	CLF	AQL, IRR, LWW, SCR, WBC A, HHP	St. Francois	725310	4181290	728440	4173621	08020202	1
2006	3138.00	St. Johns Ditch	P	15.3	15.3	Mi.	Escherichia coli (W)	Rural NPS, Urban Runoff/Storm Sewers	WBC B	AQL, IRR, LWW, SCR, HHP	New Madrid	807943	4079163	817828	4057590	08020201	1
2006	3138.00	St. Johns Ditch	P	15.3	15.3	Mi.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, IRR, LWW, SCR, WBC B	New Madrid	817828	4057590	807943	4079163	08020201	1
2006	3135.00	Stevenson Bayou	C	6.4	6.4	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Mississippi	833337	4094443	831489	4086239	08020201	1
2006	959.00	Straight Fk.	C	6.0	6.0	Mi.	Oxygen, Dissolved (W)	Versailles WWTP	AQL	IRR, LWW, SCR, WBC B, HHP	Morgan	513048	4255154	514134	4262987	10300102	1
2014	2751.00	Strother Cr.	P	6.0	6.0	Mi.	Aquatic Macroinvertebrate Bioassessments/Unknown	Buick Lead Mine/Mill	AQL	CLF, IRR, LWW, SCR, WBC B, HHP	Iron/Reynolds	672401	4162649	680292	4163603	11010007	1, 8
2008	2751.00	Strother Cr.	P	6.0	6.0	Mi.	Lead (S)	Buick Lead Mine/Mill	AQL	CLF, IRR, LWW, SCR, WBC B, HHP	Iron/Reynolds	672401	4162649	680292	4163603	11010007	1
2010	2751.00	Strother Cr.	P	6.0	6.0	Mi.	Lead (W)	Buick Lead Mine/Mill	AQL	CLF, IRR, LWW, SCR, WBC B, HHP	Iron/Reynolds	672401	4162649	680292	4163603	11010007	1
2008	2751.00	Strother Cr.	P	6.0	6.0	Mi.	Nickel (S)	Buick Lead Mine/Mill	AQL	CLF, IRR, LWW, SCR, WBC B, HHP	Iron/Reynolds	672401	4162649	680292	4163603	11010007	1
2006	2751.00	Strother Cr.	P	6.0	6.0	Mi.	Zinc (S)	Buick Lead Mine/Mill	AQL	CLF, IRR, LWW, SCR, WBC B, HHP	Iron/Reynolds	672401	4162649	680292	4163603	11010007	1
2010	2751.00	Strother Cr.	P	6.0	6.0	Mi.	Zinc (W)	Buick Lead Mine/Mill	AQL	CLF, IRR, LWW, SCR, WBC B, HHP	Iron/Reynolds	672401	4162649	680292	4163603	11010007	1
2008	3965.00	Strother Cr.	US	0.9	0.9	Mi.	Arsenic (S)	Buick Lead Mine/Mill	GEN		Reynolds/Iron	671133	4161733	672400	4162646	11010007	1, 7
2008	3965.00	Strother Cr.	US	0.9	0.9	Mi.	Lead (S)	Buick Lead Mine/Mill	GEN		Reynolds/Iron	671133	4161733	672402	4162649	11010007	1, 7
2008	3965.00	Strother Cr.	US	0.9	0.9	Mi.	Nickel (S)	Buick Lead Mine/Mill	GEN		Reynolds/Iron	671139	4161736	672405	4162651	11010007	1, 7
2006	3965.00	Strother Cr.	US	0.9	0.9	Mi.	Zinc (S)	Buick Lead Mine/Mill	GEN		Reynolds/Iron	671143	4161738	672403	4162650	11010007	1, 7
2012	3965.00	Strother Cr.	US	0.9	0.9	Mi.	Zinc (W)	Buick Lead Mine/Mill	GEN		Reynolds/Iron	671137	4161735	672405	4162650	11010007	1, 7
2006	686.00	Sugar Cr.	P	6.8	6.8	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Randolph	544656	4369584	538213	4368067	10280203	1
2014	7166.00	Sugar Creek Lake	L1	308.0	308.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, DWS, IRR, LWW, SCR, WBC B	Randolph	544674	4369569	544674	4369569	10280203	1, 5
2006	7399.00	Sunset Lake	L3	6.0	6.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, IRR, LWW, SCR, WBC B	Cole	569966	4268303	569966	4268303	10300102	1
2002	7313.00	Table Rock Lake	L2	24218.0	41747.0	Ac.	Chlorophyll-a (W)	Municipal Point Source Discharges, Nonpoint Source	AQL	IRR, LWW, SCR, WBC A, HHP	Taney	472136	4050038	472136	4050038	11010001	1, 4
2002	7313.00	Table Rock Lake	L2	24216.0	41747.0	Ac.	Nitrogen, Total (W)	Municipal Point Source Discharges, Nonpoint Source	AQL	IRR, LWW, SCR, WBC A, HHP	Taney	472138	4050042	472138	4050042	11010001	1, 4
2002	7313.00	Table Rock Lake	L2	41747.0	41747.0	Ac.	Nutrient/Eutrophication Biol. Indicators (W)	Municipal Point Source Discharges, Nonpoint Source	AQL	IRR, LWW, SCR, WBC A, HHP	Taney	472135	4050041	472135	4050041	11010001	1, 4
2010	7297.00	Terre Du Lac Lakes	L3	103.0	371.4	Ac.	Nitrogen, Total (W)	Terre du Lac Subdivision	AQL	IRR, LWW, SCR, WBC A, HHP	St. Francois	708570	4197151	708570	4197151	07140104	1, 4, 9
2016	**7352.00**	**Thirtyfour Corner Blue Hole**	**L3**	**9.0**	**9.0**	**Ac.**	**Mercury in Fish Tissue (T)**	**Atmospheric Deposition - Toxics**	**HHP**	**AQL, IRR, LWW, SCR, WBC B**	**Mississippi**	**841119**	**4076619**	**841119**	**4076619**	**08010100**	**1**

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Year	WBID	Waterbody	Cls	Imp Size	WB Size	Units	Pollutant	Source	IU	OU	U/D County	Up X	Up Y	Down X	Down Y	WBD 8	Comments
2008	549.00	Thompson R.	P	5.2	70.6	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, DWS, IRR, LWW, SCR, HHP	Harrison	432172	4492124	430916	4488363	10280102	1, 5
2012	3243.00	Thurman Cr.	P	3.0	3.0	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, IRR, LWW, SCR, HHP	Newton	369319	4099003	367458	4097252	11070207	1
2010	2114.00	Trib. Old Mines Cr.	C	1.5	1.5	Mi.	Sedimentation/Siltation (S)	Barite tailings pond	GEN	AQL, IRR, LWW, SCR, WBC B, HHP	Washington	699696	4215163	698452	4216961	07140104	1, 7
2010	133.00	Trib. to Coon Cr.	C	2.0	2.0	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Randolph	552198	4364074	554325	4364132	07110006	1
2011	3938.00	Trib. to Flat R.	US	0.3	0.3	Mi.	Zinc (W)	Elvins Chat Pile	GEN		St. Francois	717153	4191147	717584	4190839	07140104	1, 7
2010	1420.00	Trib. to Goose Cr.	C	3.0	3.0	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, IRR, LWW, SCR, HHP	Lawrence	437166	4110190	440767	4112989	10290106	1
2006	3490.00	Trib. to L. Muddy Cr.	C	1.0	1.0	Mi.	Chloride (W)	Tyson Foods	AQL	IRR, LWW, SCR, WBC B, HHP	Pettis	473618	4290951	474708	4291640	10300103	1
2006	3360.00	Trib. to Red Oak Cr.	P	0.5	0.5	Mi.	Oxygen, Dissolved (W)	Owensville WWTP	AQL	IRR, LWW, SCR, WBC B, HHP	Gasconade	635575	4245150	636297	4244762	07140103	1
2006	3361.00	Trib. to Red Oak Cr.	C	1.9	1.9	Mi.	Oxygen, Dissolved (W)	Owensville WWTP, Source Unknown	AQL	IRR, LWW, SCR, HHP	Gasconade	632983	4245771	635575	4245150	07140103	1
2014	3981.00	Trib. to Shoal Cr.	US	1.6	1.6	Mi.	Cadmium (W)	Tanyard Hollow Pits	GEN		Jasper/Newton	360497	4102911	360999	4100170	11070207	1, 7
2014	3981.00	Trib. to Shoal Cr.	US	1.6	1.6	Mi.	Zinc (W)	Tanyard Hollow Pits	GEN		Jasper/Newton	360493	4102902	360998	4100170	11070207	1, 7
2014	3982.00	Trib. to Shoal Cr.	US	2.2	2.2	Mi.	Zinc (W)	Maiden Lane Pits	GEN		Jasper/Newton	363556	4103320	363401	4100264	11070207	1, 7
2014	3983.00	Trib. to Turkey Cr.	US	2.9	2.9	Mi.	Cadmium (S)	Abandoned Smelter Site	GEN		Jasper	364260	4105805	364073	4108154	11070207	1, 7
2016	**3983.00**	**Trib. to Turkey Cr.**	**US**	**2.9**	**2.9**	**Mi.**	**Cadmium (W)**	**Abandoned Smelter Site**	**GEN**		**Jasper**	**364620**	**4106681**	**364060**	**4108161**	**11070207**	**1, 7**
2014	3983.00	Trib. to Turkey Cr.	US	2.9	2.9	Mi.	Lead (S)	Abandoned Smelter Site	GEN		Jasper	364259	4105803	364073	4108154	11070207	1, 7
2014	3983.00	Trib. to Turkey Cr.	US	2.9	2.9	Mi.	Zinc (S)	Abandoned Smelter Site	GEN		Jasper	364261	4105805	364069	4108156	11070207	1, 7
2014	3983.00	Trib. to Turkey Cr.	US	2.9	2.9	Mi.	Zinc (W)	Abandoned Smelter Site	GEN		Jasper	364060	4108161	364262	4105804	11070207	1, 7
2016	**3984.00**	**Trib. to Turkey Cr.**	**US**	**2.2**	**2.2**	**Mi.**	**Cadmium (W)**	**Mill Tailings**	**GEN**		**Jasper**	**362859**	**4108609**	**362490**	**4105692**	**11070207**	**1, 7**
2014	3984.00	Trib. to Turkey Cr.	US	2.2	2.2	Mi.	Zinc (W)	Leadwood Hollow pits	GEN		Jasper	362856	4108621	362494	4105702	11070207	1, 7
2014	3985.00	Trib. to Turkey Cr.	US	1.6	1.6	Mi.	Zinc (W)	Chitwood Hollow pits	GEN		Jasper	361695	4107018	361609	4109130	11070207	1, 7
2006	956.00	Trib. to Willow Fk.	C	0.5	0.5	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, HHP	Moniteau	520018	4276045	520577	4275439	10300102	1
2006	3589.00	Trib. to Wolf Cr.	C	1.5	1.5	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	St. Francois	727181	4185394	729121	4184284	08020202	1
2006	74.00	Troublesome Cr.	C	6.1	41.3	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Knox	581617	4441608	586195	4437679	07110003	1
2012	74.00	Troublesome Cr.	C	41.3	41.3	Mi.	Sedimentation/Siltation (S)	Habitat Mod. - other than Hydromod.	AQL	IRR, LWW, SCR, WBC B, HHP	Knox/Marion	581617	4441608	613693	4417997	07110003	1
2016	**3174.00**	**Truitt Cr.**	**P**	**1.5**	**1.5**	**Mi.**	**Escherichia coli (W)**	**Rural NPS**	**WBC B**	**AQL, IRR, LWW, SCR, HHP**	**Lawrence**	**424213**	**4108968**	**423882**	**4106865**	**11070207**	**1**
2012	3175.00	Truitt Cr.	C	6.4	6.4	Mi.	Escherichia coli (W)	Rural NPS	SCR	AQL, IRR, LWW, HHP	Lawrence	424213	4108968	429512	4115867	11070207	1
2012	751.00	Turkey Cr.	C	6.3	6.3	Mi.	Escherichia coli (W)	Source Unknown	WBC A	AQL, IRR, LWW, SCR, HHP	Boone	565489	4300829	560346	4298772	10300102	1
2006	3216.00	Turkey Cr.	P	7.7	7.7	Mi.	Cadmium (S)	Tri-State Mining District	AQL	IRR, LWW, SCR, WBC B, HHP	Jasper	366144	4107717	356267	4109959	11070207	1
2006	3216.00	Turkey Cr.	P	7.7	7.7	Mi.	Cadmium (W)	Tri-State Mining District	AQL	IRR, LWW, SCR, WBC B, HHP	Jasper	366144	4107717	356267	4109959	11070207	1
2008	3216.00	Turkey Cr.	P	7.7	7.7	Mi.	Lead (S)	Tri-State Mining District	AQL	IRR, LWW, SCR, WBC B, HHP	Jasper	366144	4107717	356267	4109959	11070207	1
2006	3216.00	Turkey Cr.	P	7.7	7.7	Mi.	Zinc (S)	Tri-State Mining District	AQL	IRR, LWW, SCR, WBC B, HHP	Jasper	366144	4107717	356267	4109959	11070207	1
2006	3217.00	Turkey Cr.	P	6.1	6.1	Mi.	Cadmium (S)	Tri-State Mining District	AQL	IRR, LWW, SCR, WBC A, HHP	Jasper	373143	4104208	366144	4107717	11070207	1
2006	3217.00	Turkey Cr.	P	6.1	6.1	Mi.	Escherichia coli (W)	Urban Runoff/Storm Sewers	WBC A	AQL, IRR, LWW, SCR, HHP	Jasper	373143	4104208	366144	4107717	11070207	1
2006	3217.00	Turkey Cr.	P	6.1	6.1	Mi.	Zinc (S)	Tri-State Mining District	AQL	IRR, LWW, SCR, WBC A, HHP	Jasper	373143	4104208	366144	4107717	11070207	1

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Year	WBID	Waterbody	Cls	Imp Size	WB Size	Units	Pollutant	Source	IU	OU	U/D County	Up X	Up Y	Down X	Down Y	WBD 8	Comments
2016	**3282.00**	**Turkey Cr.**	**P**	**2.4**	**2.4**	**Mi.**	**Cadmium (S)**	**Bonne Terre chat pile**	**AQL**	**IRR, LWW, SCR, WBC B, HHP**	**St. Francois**	**715493**	**4200128**	**714636**	**4203638**	**07140104**	**1**
2006	3282.00	Turkey Cr.	P	2.4	2.4	Mi.	Cadmium (W)	Bonne Terre chat pile	AQL	IRR, LWW, SCR, WBC B, HHP	St. Francois	715493	4200128	714636	4203638	07140104	1
2016	**3282.00**	**Turkey Cr.**	**P**	**2.4**	**2.4**	**Mi.**	**Copper (S)**	**Bonne Terre chat pile**	**AQL**	**IRR, LWW, SCR, WBC B, HHP**	**St. Francois**	**715493**	**4200128**	**714636**	**4203638**	**07140104**	**1**
2016	**3282.00**	**Turkey Cr.**	**P**	**2.4**	**2.4**	**Mi.**	**Lead (S)**	**Bonne Terre chat pile**	**AQL**	**IRR, LWW, SCR, WBC B, HHP**	**St. Francois**	**715493**	**4200128**	**714636**	**4203638**	**07140104**	**1**
2006	3282.00	Turkey Cr.	P	2.4	2.4	Mi.	Lead (W)	Bonne Terre chat pile	AQL	IRR, LWW, SCR, WBC B, HHP	St. Francois	715493	4200128	714636	4203638	07140104	1
2016	**3282.00**	**Turkey Cr.**	**P**	**2.4**	**2.4**	**Mi.**	**Nickel (S)**	**Bonne Terre chat pile**	**AQL**	**IRR, LWW, SCR, WBC B, HHP**	**St. Francois**	**715493**	**4200128**	**714636**	**4203638**	**07140104**	**1**
2016	**3282.00**	**Turkey Cr.**	**P**	**2.4**	**2.4**	**Mi.**	**Zinc (S)**	**Bonne Terre chat pile**	**AQL**	**IRR, LWW, SCR, WBC B, HHP**	**St. Francois**	**715493**	**4200128**	**714636**	**4203638**	**07140104**	**1**
2006	3282.00	Turkey Cr.	P	1.2	2.4	Mi.	Zinc (W)	Bonne Terre chat pile	AQL	IRR, LWW, SCR, WBC B, HHP	St. Francois	715072	4201827	715495	4200135	07140104	1
2010	1414.00	Turnback Cr.	P	19.9	19.9	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, CDF, IRR, LWW, SCR, HHP	Lawrence/Dade	445684	4108548	432264	4127720	10290106	1
2016	**4079.00**	**Twomile Creek**	**C**	**5.6**	**5.6**	**Mi.**	**Escherichia coli (W)**	**Urban Runoff/Storm Sewers**	**WBC B**	**AQL, IRR, LWW, SCR, HHP**	**St. Louis**	**721592**	**4277889**	**728708**	**4277778**	**07140101**	**1**
2016	**7099.00**	**Unity Village Lake #2**	**L1**	**26.0**	**26.0**	**Ac.**	**Mercury in Fish Tissue (T)**	**Atmospheric Deposition - Toxics**	**HHP**	**AQL, DWS, IRR, LWW, SCR, WBC B**	**Jackson**	**379080**	**4313288**	**379080**	**4313288**	**10300101**	**1, 5**
2008	2755.00	W. Fk. Black R.	P	2.1	32.3	Mi.	Lead (S)	West Fork Lead Mine/Mill	AQL	CLF, IRR, LWW, SCR, WBC A, HHP	Reynolds	667310	4151001	669784	4151630	11010007	1
2008	2755.00	W. Fk. Black R.	P	2.1	32.3	Mi.	Nickel (S)	West Fork Lead Mine/Mill	AQL	CLF, IRR, LWW, SCR, WBC A, HHP	Reynolds	667305	4151008	669785	4151637	11010007	1
2006	1317.00	W. Fk. Dry Wood Cr.	C	8.1	8.1	Mi.	Oxygen, Dissolved (W)	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Vernon	357350	4172196	363431	4175252	10290104	1
2006	2579.00	Warm Fk. Spring R.	P	13.8	13.8	Mi.	Fecal Coliform (W)	Source Unknown	WBC A	AQL, IRR, LWW, SCR, HHP	Oregon	627789	4054485	631878	4040300	11010010	1, 2
2006	1708.00	Watkins Cr.	C	1.4	1.4	Mi.	Chloride (W)	Urban Runoff/Storm Sewers	AQL	IRR, LWW, SCR, WBC B, HHP	St. Louis/St. Louis City	744084	4294764	745936	4294861	07140101	1
2006	1708.00	Watkins Cr.	C	1.4	1.4	Mi.	Escherichia coli (W)	Urban Runoff/Storm Sewers	WBC B	AQL, IRR, LWW, SCR, HHP	St. Louis/St. Louis City	744084	4294764	745936	4294861	07140101	1
2016	**4097.00**	**Watkins Creek tributary**	**C**	**1.2**	**1.2**	**Mi.**	**Escherichia coli (W)**	**Urban Runoff/Storm Sewers**	**WBC B, SCR**	**AQL, IRR, LWW, HHP**	**St. Louis**	**740625**	**4297157**	**741049**	**4295353**	**07140101**	**1**
2016	**4098.00**	**Watkins Creek tributary**	**C**	**1.2**	**1.2**	**Mi.**	**Escherichia coli (W)**	**Urban Runoff/Storm Sewers**	**WBC B, SCR**	**AQL, IRR, LWW, HHP**	**St. Louis**	**743158**	**4295677**	**742995**	**4294040**	**07140101**	**1**
2012	7071.00	Weatherby Lake	L3	185.0	185.0	Ac.	Chlorophyll-a (W)	Urban Runoff/Storm Sewers	AQL	IRR, LWW, SCR, WBC A, HHP	Platte	352913	4343568	352913	4343568	10240011	1, 4
2012	7071.00	Weatherby Lake	L3	185.0	185.0	Ac.	Mercury in Fish Tissue (T)	Atmospheric Deposition - Toxics	HHP	AQL, IRR, LWW, SCR, WBC A	Platte	352894	4343566	352894	4343566	10240011	1
2010	7071.00	Weatherby Lake	L3	185.0	185.0	Ac.	Nitrogen, Total (W)	Urban Runoff/Storm Sewers	AQL	IRR, LWW, SCR, WBC A, HHP	Platte	352918	4343554	352918	4343554	10240011	1, 4
2014	7071.00	Weatherby Lake	L3	185.0	185.0	Ac.	Phosphorus, Total (W)	Urban Runoff/Storm Sewers	AQL	IRR, LWW, SCR, WBC A, HHP	Platte	352909	4343562	352909	4343562	10240011	1, 4
2006	560.00	Weldon R.	P	43.4	43.4	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, IRR, LWW, SCR, HHP	Mercer/Grundy	448318	4492214	444714	4439341	10280102	1
2008	1504.00	Whetstone Cr.	P	12.2	12.2	Mi.	Oxygen, Dissolved (W)	Rural NPS	AQL	CLF, IRR, LWW, SCR, WBC B, HHP	Wright	556418	4116032	553965	4129663	10290201	1
2010	3182.00	White Oak Cr.	C	18.0	18.0	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, IRR, LWW, SCR, HHP	Lawrence/Jasper	415932	4124150	396440	4113581	11070207	1
2012	1700.00	Wildhorse Cr.	C	3.9	3.9	Mi.	Escherichia coli (W)	Rural, Residential Areas	WBC B	AQL, IRR, LWW, SCR, HHP	St. Louis	699002	4276141	699384	4279922	10300200	1

Missouri Department of Natural Resources
2016 CWC Section 303(d) Listed Waters

Year	WBID	Waterbody	Cls	Imp Size	WB Size	Units	Pollutant	Source	IU	OU	U/D County	Up X	Up Y	Down X	Down Y	WBD 8	Comments
2010	3171.00	Williams Cr.	P	1.0	1.0	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, CDF, IRR, LWW, SCR, HHP	Lawrence	421759	4107281	420777	4107593	11070207	1
2010	3172.00	Williams Cr.	P	8.5	8.5	Mi.	Escherichia coli (W)	Rural NPS	WBC A	AQL, IRR, LWW, SCR, HHP	Lawrence	432044	4105526	421759	4107281	11070207	1
2012	3594.00	Williams Cr.	P	1.0	1.0	Mi.	Escherichia coli (W)	Rural NPS	WBC B, SCR	AQL, IRR, LWW, HHP	St. Louis	716804	4268162	716672	4269382	07140102	1
2010	3280.00	Willow Br.	P	2.2	2.2	Mi.	Escherichia coli (W)	Rural NPS	WBC B	AQL, IRR, LWW, SCR, HHP	Newton	366154	4086266	364028	4084114	11070206	1
2014	3280.00	Willow Br.	P	2.2	2.2	Mi.	Zinc (S)	Mill Tailings	AQL	IRR, LWW, SCR, WBC B, HHP	Newton	366154	4086266	364028	4084114	11070206	1
2006	955.00	Willow Fk.	C	6.8	6.8	Mi.	Oxygen, Dissolved (W)	Tipton WWTP, Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Moniteau	515565	4276527	522997	4273676	10300102	1
2014	2375.00	Wilsons Cr.	P	2.9	14.0	Mi.	Benzo-a-anthracene (S)	Nonpoint Source	AQL	IRR, LWW, SCR, WBC B, HHP	Greene	471019	4115737	467546	4115846	11010002	1
2006	2375.00	Wilsons Cr.	P	11.9	14.0	Mi.	Escherichia coli (W)	Nonpoint Source	WBC B	AQL, IRR, LWW, SCR, HHP	Greene/Christian	468463	4116799	464366	4102525	11010002	1
2014	2375.00	Wilsons Cr.	P	2.9	14.0	Mi.	Chrysene, C1-C4 (S)	Nonpoint Source	AQL	IRR, LWW, SCR, WBC B, HHP	Greene	471019	4115737	467546	4115846	11010002	1
2014	2375.00	Wilsons Cr.	P	2.9	14.0	Mi.	Fluoranthene (S)	Nonpoint Source	AQL	IRR, LWW, SCR, WBC B, HHP	Greene	471019	4115737	467546	4115846	11010002	1
2014	2375.00	Wilsons Cr.	P	2.9	14.0	Mi.	Phenanthrene (S)	Nonpoint Source	AQL	IRR, LWW, SCR, WBC B, HHP	Greene	471019	4115737	467546	4115846	11010002	1
2014	2375.00	Wilsons Cr.	P	2.9	14.0	Mi.	Pyrene (S)	Nonpoint Source	AQL	IRR, LWW, SCR, WBC B, HHP	Greene	471019	4115737	467546	4115846	11010002	1
2014	2429.00	Woods Fk.	C	5.5	5.5	Mi.	Fishes Bioassessments/Unknown	Source Unknown	AQL	IRR, LWW, SCR, WBC B, HHP	Christian	480105	4082576	483619	4077550	11010003	1, 8

Water quality data summaries for waters on this list can be found on the department's 303(d) Web site at:
http://www.dnr.mo.gov/env/wpp/waterquality/303d.htm

Key to List
Year= Year this water body/pollutant was added to the 303(d) List
WBID= Unique water body indentification number
WB Size= Size of the entire waterbody
Cls= Water body classification in state water quality standards: P= permanently flowing waters, C= intermittent streams, L1= Drinking water lakes, L2= large multi-purpose lakes, L3= other recreational lakes, US= unclassified stream, UL= unclassified lake
Pollutant = Reason the water is impaired.
pH= degree of acidity or alkalinity of water, Hydromod.= Hydromodification, which is typically related to the operation of dams.
(W) pollutant is in the water, (S) pollutant is in the sediment, (T) pollutant is in fish tissue.
If none of these three options are shown, the pollutant is in the water.
Sources = The pollutant source causing the impairment. WWTP= Wastewater treatment plant, PP= Power Plant, Unk.= Unknown, Aban. = Abandoned, Atmospheric Dep. = Atmospheric deposition (primarily rainfall), Mult.= Multiple, NPS= Non-point source, Pt.= Point Source, Rereg. Dam= Reregulation Dam - a low dam downstream of a larger hydroelectric dam.
IU = Impaired Beneficial Use(s). Those beneficial uses, assigned to this water in state water quality standards, that are not being met due to water pollution.
OU= Other Beneficial Use(s). Those beneficial uses assigned to this water in state water quality standard, that are not affected by the pollution.
Use codes for IU and OU columns are: GEN= General Criteria, HHP= Human Health-Fish Consumption, AQL= Protection of aquatic life, WBC A and B = Whole Body Contact Recreation , DWS= Public Drinking Water Supply, LWW = Livestock and Wildlife Watering, SCR= Secondary Contact Recreation (Fishing and Boating), IRR= Irrigation, IND= Industrial Water
Up X = X coordinate of upstream end of impaired water body (in UTM)
Up Y = Y coordinate of upstream end of impaired water body (in UTM)
Down X = X coordinate of downstream end of impaired water body (in UTM)
Down Y = Y coordinate of downstream end of impaired water body (in UTM)
County U/D = County the impaired segment is in. If the impaired segment is is more than one county, the county of the upstream and downstream ends

Year	WBID	Waterbody	Cls	Imp Size	WB Size	Units	Pollutant	Source	IU	OU	U/D County	Up X	Up Y	Down X	Down Y	WBD 8	Comments

of the impaired segment are given

Comment:

1= 2016 Assessment indicates impairment
2= Assessment shows existing data insufficient to show 'good cause' for de-listing.
3= Biological data does not support de-listing
4= Nutrient Related Impairment
5= Water is a Public Drinking Water Supply
6= Monsanto Lake is part of St. Joe State Park Lakes
7= Genral Use pertaining to Aquatic Life
8=These waters are listed as either "Aquatic Macroinvertebrate Bioassessment/Unknown" or "Fishes Bioassessment/Unknown" . These waters lack the necessary information to point to a discrete pollutant and also do not show signs of habitat impairment. Since we currently cannot point to a specific pollutant as the cause we are listing the reason as to why the water is believed to be impaired.
9= Only Lac Capri is imapired.

Missouri Department of Natural Resources, Water Protection Program
03/30/16

APPENDIX C

TMDL Schedule and Section 303(d) Prioritization

Tentative Schedule for the Completion of Total Maximum Daily Load Studies.

TMDL Schedule FFY	Water Body Name	WBID	Class	Impaired Segment Size (mi/acres)	Classified Segment Size (mi/acres)	County	Pollutant	Impaired Uses
2015	Antire Cr.	2188	P	1.9	1.9	St. Louis	Escherichia coli	WBC-B
2018	Antire Cr.	2188	P	1.9	1.9	St. Louis	pH (W)	AQL
2017	Bass Cr.	0752	C	4.4	4.4	Boone	Escherichia coli	WBC-A
2016	Baynham Br.	3240	P	4	4	Newton	Escherichia coli	WBC-B
2020	Bee Fork	2760	C	1.4	8.7	Reynolds	Lead (W)	AQL
2024	Bee Tree Lake	7309	L3	10.0	10.0	St. Louis	Mercury (T)	AQL
2024	Beef Br.	3224	P	2.5	2.5	Newton	Zinc (W)	AQL
2024	Beef Br.	3224	P	2.5	2.5	Newton	Cadmium (W)	AQL
2024	Beef Br.	3224	P	2.5	2.5	Newton	Cadmium (S)	AQL
2024	Beef Br.	3224	P	2.5	2.5	Newton	Lead (S)	AQL
2024	Beef Br.	3224	P	2.5	2.5	Newton	Zinc (S)	AQL
2016	Belcher Branch Lake	7365	L3	55	55	Buchanan	Mercury (T)	AQL
2024	Bens Br.	3980	US	5.8	5.8	Jasper	Cadmium (S)	GEN
2024	Bens Br.	3980	US	5.8	5.8	Jasper	Lead (S)	GEN
2024	Bens Br.	3980	US	5.8	5.8	Jasper	Zinc (S)	GEN
2017	Big Creek	1250	P	70.5	70.5	Jackson/Henry	Escherichia coli	WBC-B
2022	Big Creek	0444	P	1	22	Harrison	Ammonia	AQL
2022	Big Creek	0444	P	6	22	Harrison	Oxygen, Dissolved	AQL
2024	Big Creek	2916	P	3	34.1	Wayne/Iron	Cadmium (S)	AQL
2024	Big Creek	2916	P	3	34.1	Wayne/Iron	Lead (S)	AQL
2024	Big Piney River	1578	P	4	8	Texas	Oxygen, Dissolved	AQL
2015	Big R.	2080	P	52.3	81.3	St. Francois/Jefferson	Lead (S)	AQL
2015	Big R.	2080	P	18.6	68	St. Francois	Cadmium (S)	AQL
2015	Black Cr.	0111	C	19.4	19.4	Shelby	Escherichia coli	WBC B
2015	Black Cr.	3825	P	1.6	1.6	St. Louis	Escherichia coli	SCR, WBC B
2018	Black Cr.	3825	P	1.6	1.6	St. Louis	Chloride	AQL
2025	Black Cr.	0111	C	19.4	19.4	Shelby	Oxygen, Dissolved	AQL
2016	Black River	2784	P	39	39	Wayne/Butler	Mercury (T)	AQL
2016	Black River	2769	P	47.1	47.1	Butler	Mercury (T)	AQL
2016	Blackberry Creek	3184	C	3.5	6.5	Jasper	Chloride	AQL
2016	Blackberry Creek	3184	C	3.5	6.5	Jasper	Total Dissolved Solids	AQL

TMDL Schedule FFY	Water Body Name	WBID	Class	Impaired Segment Size (mi/acres)	Classified Segment Size (mi/acres)	County	Pollutant	Impaired Uses
2014	Blue River	0417	P	4.4	4.4	Jackson	Escherichia coli	WBC-B
2014	Blue River	0418	P	9.4	9.4	Jackson	Escherichia coli	WBC-B
2014	Blue River	0419	P	7.7	7.7	Jackson	Escherichia coli	WBC-A
2014	Blue River	0421	C	12	12	Jackson	Escherichia coli	WBC-B
2015	Bonhomme Cr.	1701	C	2.5	2.5	St. Louis	Escherichia coli	WBC-B
2018	Bonhomme Cr.	1701	C	2.5	2.5	St. Louis	pH	AQL
2017	Bonne Femme Creek	0750	P	7.8	7.8	Boone	Escherichia coli	WBC-A
2017	Bonne Femme Creek	0753	C	7	7	Boone	Escherichia coli	WBC-B
2016	Bourbeuse River	2034	P	136.7	136.7	Phelps/Franklin	Mercury (T)	AQL
2017	Bowling Green (Old) Lake	7003	L1	28.2	28.2	Pike	Nitrogen, Total	AQL
2017	Bowling Green (Old) Lake	7003	L1	28.2	28.2	Pike	Phosphorus, Total	AQL
2024	Bowling Green (Old) Lake	7003	L1	7.0	7.0	Pike	Chlorophyll-a (W)	AQL
2021	Brazeau Cr.	1796	P	10.8	10.8	Perry	Escherichia coli	WBC B
2019	Brush Creek	1371	P	4.7	4.7	Polk/St. Clair	Oxygen, Dissolved	AQL
2023	Buffalo Cr.	3273	P	8	8	Newton/McDonald	Fishes Bioassessments/Unknown	AQL
2017	Burgher Branch	1865	C	2	2	Phelps	Oxygen, Dissolved	AQL
2016	Busch Lake #35	7057	L3	51	51	St. Charles	Mercury (T)	AQL
2016	Busch Lake #37	7627	U	34	34	St. Charles	Mercury (T)	GEN
2016	Capps Creek	3234	P	5	5	Barry	Escherichia coli	WBC-A
2015	Castor River	2288	P	7.5	7.5	Bollinger	Escherichia coli	WBC-A
2021	Cedar Creek	737	C	7.9	37.4	Boone	Aquatic Macroinvertebrate Bioassessments/Unknown	AQL
2022	Cedar Creek	1344	P	10	31	Cedar	Oxygen, Dissolved	AQL
2022	Cedar Creek	1357	C	16.2	16.2	Cedar	Oxygen, Dissolved	AQL
2023	Cedar Creek	1344	P	10	31	Cedar	Aquatic Macroinvertebrate Bioassessments/Unknown	AQL
2023	Cedar Creek	1357	C	16.2	16.2	Cedar	Aquatic Macroinvertebrate Bioassessments/Unknown	AQL
2024	Center Cr.	3203	P	26.8	26.8	Jasper	Escherichia coli	WBC A
2014	Center Creek	3214	P	4.9	4.9	Lawrence/Newton	Escherichia coli	WBC A
2014	Center Creek	3210	P	21	21	Newton/Jasper	Escherichia coli	WBC A
2019	Center Creek	3203	P	19	26.8	Jasper	Cadmium (S)	AQL
2019	Center Creek	3203	P	19	26.8	Jasper	Cadmium (W)	AQL
2019	Center Creek	3203	P	19	26.8	Jasper	Lead (S)	AQL
2024	Chaumiere Lake	7634	UL	3.4	3.4	Clay	Mercury (T)	GEN

TMDL Schedule FFY	Water Body Name	WBID	Class	Impaired Segment Size (mi/acres)	Classified Segment Size (mi/acres)	County	Pollutant	Impaired Uses
2021	Cinques Hommes Cr.	1781	C	8.3	17.1	Perry	Escherichia coli	WBC-B
2016	Clear Creek	3238	P	11.1	11.1	Barry/Newton	Escherichia coli	WBC-B
2019	Clear Creek	3239	C	3.5	3.5	Barry/Newton	Nutrient/Eutroph. Biol. indicators	AQL
2019	Clear Creek	3239	C	3.5	3.5	Barry/Newton	Oxygen, Dissolved	AQL
2022	Clear Creek	1336	C	15	15	Vernon	Oxygen, Dissolved	AQL
2022	Clear Creek	1333	P	15.5	15.5	Vernon/St. Clair	Oxygen, Dissolved	AQL
2018	Clear Fk.	935	P	3.1	25.8	Johnson	Oxygen, Dissolved	AQL
2016	Clearwater Lake	7326	L2	1635	1635	Reynolds/Wayne	Mercury (T)	AQL
2024	Clearwater Lake	7326	L2	1635.0	1635.0	Wayne	Chlorophyll-a (W)	AQL
2014	Coldwater Creek	1706	C	5.5	5.5	St. Louis	Escherichia coli	WBC B
2018	Coldwater Creek	1706	C	5.5	5.5	St. Louis	Chloride	AQL
2026	Coonville Cr.	2177	C	1.3	1.3	St. Francois	Lead (W)	AQL
2026	Courtois Creek	1943	P	2.6	32	Washington	Lead (S)	AQL
2026	Courtois Creek	1943	P	2.6	32	Washington	Zinc (S)	AQL
2023	Crane Cr.	2382	P	13.2	13.2	Stone	Aquatic Macroinvertebrate Bioassessments/Unknown	AQL
2024	Craven Ditch	2816	C	11.6	11.6	Butler	Oxygen, Dissolved	AQL
2014	Creve Coeur Creek	1703	C	3.8	3.8	St. Louis	Escherichia coli	WBC B
2018	Creve Coeur Creek	1703	C	3.8	3.8	St. Louis	Chloride	AQL
2019	Creve Coeur Creek	1703	C	3.8	3.8	St. Louis	Oxygen, Dissolved	AQL
2020	Crooked Creek	1928	P	3.5	3.5	Dent/Crawford	Cadmium (S)	AQL
2020	Crooked Creek	1928	P	3.5	3.5	Dent/Crawford	Cadmium (W)	AQL
2020	Crooked Creek	3961	U	5.2	n/a	Iron/Dent	Cadmium (W)	GEN
2020	Crooked Creek	3961	U	5.2	n/a	Iron/Dent	Copper (W)	GEN
2020	Crooked Creek	1928	P	3.5	3.5	Dent/Crawford	Lead (S)	AQL
2016	Current River	2636	P	124	124	Shannon/Ripley	Mercury (T)	AQL
2016	Dardenne Creek	0221	P	16.5	16.5	St. Charles	Sedimentation/Siltation	AQL
2020	Dardenne Creek	0221	P	16.5	16.5	St. Charles	Aquatic Macroinvertebrate Bioassessments/Unknown	AQL
2024	Dardenne Creek	0221	P	16.5	16.5	St. Charles	Oxygen, Dissolved	AQL
2015	Deer Cr.	3826	P	1.6	1.6	St. Louis	Escherichia coli	SCR, WBC A
2018	Deer Cr.	3826	P	1.6	1.6	St. Louis	Chloride	AQL
2016	Deer Ridge Lake	7015	L3	48	48	Lewis	Mercury (T)	AQL
2021	Ditch #36	3109	P	7	7	Dunklin	Oxygen, Dissolved	AQL
2019	Douger Br.	3810	C	3.1	3.1	Lawrence	Lead (S)	AQL
2019	Douger Br.	3810	C	3.1	3.1	Lawrence	Zinc (S)	AQL
2019	Dousinbury Creek	1180	P	3.5	3.5	Dallas	Escherichia coli	WBC B

TMDL Schedule FFY	Water Body Name	WBID	Class	Impaired Segment Size (mi/acres)	Classified Segment Size (mi/acres)	County	Pollutant	Impaired Uses
2014	Dry Fork	3189	C	10.2	10.2	Jasper	Escherichia coli	WBC A
2024	Drywood Cr.	1314	P	3.8	29.9	Barton	Total Dissolved Solids	AQL
2017	Dutro Carter Creek	3569	P	0.6	1.5	Phelps	Oxygen, Dissolved	AQL
2024	East Fork Crooked River	0372	P	14	14	Ray	Oxygen, Dissolved	AQL
2016	East Fork Grand River	0457	P	25	25	Worth/Gentry	Escherichia coli	WBC A
2014	East Fork Locust Creek	0608	P	13	13	Sullivan	Escherichia coli	WBC B
2014	East Fork Locust Creek	0610	C	0.4	13	Sullivan	Escherichia coli	WBC B
2019	East Fork Locust Creek	0610	C	12.6	13	Sullivan	Oxygen, Dissolved	AQL
2021	East Fork Tebo Creek	1282	C	10.4	14.5	Henry	Oxygen, Dissolved	AQL
2015	Eaton Branch	2166	C	0.9	1.2	St. Francois	Cadmium (S)	AQL
2015	Eaton Branch	2166	C	0.9	1.2	St. Francois	Cadmium (W)	AQL
2015	Eaton Branch	2166	C	0.9	1.2	St. Francois	Lead (S)	AQL
2015	Eaton Branch	2166	C	0.9	1.2	St. Francois	Zinc (S)	AQL
2015	Eaton Branch	2166	C	0.9	1.2	St. Francois	Zinc (W)	AQL
2016	Eleven Point River	2597	P	11.4	11.4	Oregon	Mercury (T)	AQL
2016	Eleven Point River	2601	P	22.3	22.3	Oregon	Mercury (T)	AQL
2016	Eleven Point River	2593	P	22.7	22.7	Oregon	Mercury (T)	AQL
2021	Elm Branch	1283	C	3	3	Henry	Oxygen, Dissolved	AQL
2015	Fee Fee (new) Cr.	1704	P	1.5	1.5	St. Louis	Escherichia coli	WBC B
2018	Fee Fee (new) Cr.	1704	P	1.5	1.5	St. Louis	Chloride	AQL
2016	Fellows Lake	7237	L1	800.0	800	Greene	Mercury (T)	AQL
2015	Fenton Cr.	3595	P	0.5	0.5	St. Louis	Escherichia coli	WBC B
2014	Fishpot Creek	2186	P	2	2	St. Louis	Escherichia coli	WBC B
2018	Fishpot Creek	2186	P	2	2	St. Louis	Chloride	AQL
2015	Flat River Creek	2168	C	5	9	St. Francois	Cadmium (W)	AQL
2018	Forest Lake	7151	L1	573	573	Adair	Chlorophyll	AQL
2018	Forest Lake	7151	L1	573	573	Adair	Nitrogen	AQL
2018	Forest Lake	7151	L1	573	573	Adair	Phosphorus	AQL
2021	Fowler Creek	0747	C	6	6	Boone	Oxygen, Dissolved	AQL
2023	Fox Cr.	1842	P	7.2	7.2	St. Louis	Aquatic Macroinvertebrate Bioassessments/Unknown	AQL
2016	Fox River	0038	P	42	42	Clark	Escherichia coli	WBC B
2017	Fox Valley Lake	7008	L3	89	89	Clark	Phosphorus	AQL
2024	Fox Valley Lake	7008	L3	89.0	89.0	Clark	Chlorophyll-a (W)	AQL
2024	Fox Valley Lake	7008	L3	89.0	89.0	Clark	Nitrogen, Total (W)	AQL
2016	Foxboro Lake	7382	L3	22	22	Franklin	Mercury (T)	AQL
2016	Frisco Lake	7280	L3	5	5	Phelps	Mercury (T)	AQL

TMDL Schedule FFY	Water Body Name	WBID	Class	Impaired Segment Size (mi/acres)	Classified Segment Size (mi/acres)	County	Pollutant	Impaired Uses
2017	Gans Cr.	1004	C	5.5	5.5	Boone	Escherichia coli	WBC-A
2016	Gasconade River	1455	P	249	249	Gasconade/Wright	Mercury (T)	AQL
2015	Grand Glaize Cr.	2184	C	4.0	4.0	St. Louis	Escherichia coli (W)	WBC B
2016	Grand Glaize Creek	2184	C	4	4	St. Louis	Mercury (T)	AQL
2018	Grand Glaize Creek	2184	C	4	4	St. Louis	Chloride	AQL
2014	Grand River	0593	P	60	60	Livingston/Chariton	Escherichia coli	SCR, WBC A
2016	Gravois Creek	1712	P	2	2	St. Louis	Escherichia coli	WBC B
2016	Gravois Creek	1713	C	4	4	St. Louis	Escherichia coli	WBC B
2018	Gravois Creek	1712	P	2	2	St. Louis	Chloride	AQL
2018	Gravois Creek	1713	C	4	4	St. Louis	Chloride	AQL
2017	Grindstone Creek	1009	C	1.5	2.5	Boone	Escherichia coli	WBC A
2024	Harrison County Lake	7386	L1	280.0	280.0	Harrison	Mercury (T)	AQL
2016	Hazel Creek Lake	7152	L1	151	151	Adair	Mercury (T)	AQL
2017	Hazel Creek Lake	7152	L1	151	151	Adair	Chlorophyll	AQL
2022	Heath's Cr.	0848	P	21	21	Pettis	Oxygen, Dissolved	AQL
2024	Hickory Br.	596	C	6.8	6.8	Chariton	Oxygen, Dissolved	AQL
2016	Hickory Cr.	3226	P	4.9	4.9	Newton	Escherichia coli	WBC A
2017	Hinkson Cr.	1008	C	18	18	Boone	Escherichia coli	WBC B
2017	Hominy Br.	1011	C	1	1	Boone	Escherichia coli	WBC B
2014	Honey Cr.	3169	P	16.5	16.5	Lawrence	Escherichia coli	WBC B
2014	Honey Cr.	3170	C	2.7	2.7	Lawrence	Escherichia coli	WBC B
2022	Horse Cr.	1348	P	27.7	27.7	Cedar	Oxygen, Dissolved	AQL
2023	Horse Cr.	1348	P	27.7	27.7	Cedar	Aquatic Macroinvertebrate Bioassessments/Unknown	AQL
2024	Horseshoe Cr.	3413	C	5.8	5.8	Lafayette/Jackson	Oxygen, Dissolved	AQL
2016	Hough Park Lake	7388	L3	7	7	Cole	Mercury (T)	AQL
2016	Hunnewell Lake	7029	L3	228	228	Shelby	Mercury (T)	AQL
2014	Indian Cr.	0420	C	3	3	Jackson	Escherichia coli	WBC A
2016	Indian Cr.	3256	P	9.7	30.8	Newton/McDonald	Escherichia coli	WBC A
2024	Indian Cr.	0420	C	3	3	Jackson	Chloride	AQL
2026	Indian Cr.	1946	P	1.9	1.9	Washington	Lead (S)	AQL
2026	Indian Cr.	1946	P	1.9	1.9	Washington	Zinc (S)	AQL
2016	Indian Creek Lake	7389	L3	192	192	Livingston	Mercury (T)	AQL
2024	Jacobs Br.	3223	P	1.6	1.6	Newton	Cadmium (W)	AQL
2024	Jacobs Br.	3223	P	1.6	1.6	Newton	Cadmium (S)	AQL
2024	Jacobs Br.	3223	P	1.6	1.6	Newton	Lead (S)	AQL
2024	Jacobs Br.	3223	P	1.6	1.6	Newton	Zinc (S)	AQL

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2026	Jacobs Br.	3223	P	1.6	1.6	Newton	Zinc (W)	AQL
2016	Jenkins Cr.	3207	P	2.8	2.8	Newton/Jasper	Escherichia coli	WBC A
2024	Jenkins Cr.	3208	C	4.8	4.8	Newton/Jasper	Escherichia coli	WBC A
2016	Jones Cr.	3205	P	7.5	7.5	Newton/Jasper	Escherichia coli	WBC A
2014	Kiefer Cr.	3592	P	1.2	1.2	St. Louis	Escherichia coli	WBC B
2018	Kiefer Cr.	3592	P	1.2	1.2	St. Louis	Chloride	AQL
2024	L. Beaver Cr.	1529	C	3.5	3.5	Phelps	Escherichia coli	WBC A
2024	L. St. Francis R.	2854	P	24.2	32.4	Madison	Lead (S)	AQL
2016	Lake Buteo	7469	L3	7.0	7.0	Johnson	Mercury (T)	AQL
2016	Lake of the Woods	7436	L3	3	3	Boone	Mercury (T)	AQL
2016	Lake of the Woods	7629	U	7	7	Jackson	Mercury (T)	GEN
2016	Lake St. Louis	7054	L3	525	525	St. Charles	Mercury (T)	AQL
2024	Lake Ste. Louise	7055	L3	71.0	71.0	St. Charles	Mercury (T)	AQL
2016	Lake Winnebago	7212	L3	350	350	Cass	Mercury (T)	AQL
2017	Lamine R.	0847	P	54	54	Morgan/Cooper	Escherichia coli	WBC A
2021	Lat. #2 Main Ditch	3105	P	11.5	11.5	Stoddard	Oxygen, Dissolved	AQL
2021	Lat. #2 Main Ditch	3105	P	11.5	11.5	Stoddard	Temperature (W)	AQL
2021	Lee Rowe Ditch	3137	C	2.3	6	Mississippi	Oxygen, Dissolved	AQL
2015	Lewistown Lake	7020	L1	29	29	Lewis	Atrazine	DWS
2019	Line Cr.	3575	C	7	7	Platte	Escherichia coli	WBC B
2018	Little Beaver Cr.	1529	C	3.4	3.5	Phelps	Sedimentation/Siltation	AQL
2015	Little Blue R.	0422	P	35.1	35.1	Jackson	Escherichia coli	WBC B
2017	Little Bonne Femme Cr.	1003	P	9	9	Boone	Escherichia coli	WBC B
2021	Little Dry Fk.	1863	P	1	5	Phelps	Oxygen, Dissolved	AQL
2021	Little Dry Fk.	1864	C	0.6	4.5	Phelps	Oxygen, Dissolved	AQL
2021	Little Dry Fk.	1864	C	3.9	4.5	Phelps	Oxygen, Dissolved	AQL
2021	Little Drywood Cr.	1326	C	10	10	Barton/Vernon	Oxygen, Dissolved	AQL
2022	Little Drywood Cr.	1325	P	17	17	Vernon	Oxygen, Dissolved	AQL
2016	Little Lost Cr.	3279	P	5.8	5.8	Newton	Escherichia coli	WBC B
2014	Little Medicine Cr.	0623	P	20	40	Mercer/Grundy	Escherichia coli	WBC B
2023	Little Medicine Cr.	0623	P	40	40	Mercer/Grundy	Aquatic Macroinvertebrate Bioassessments/Unknown	AQL
2021	Little Niangua R.	1189	P	20	43	Dallas/Camden	Oxygen, Dissolved	AQL
2017	Little Osage R.	3652	C	16	16	Vernon	Escherichia coli	WBC B
2023	Little Whitewater R.	2229	P	24.2	24.2	Cape G/Bollinger	Aquatic Macroinvertebrate Bioassessments/Unknown	AQL
2014	Locust Cr.	0606	P	36.4	84	Putnam/Sullivan	Escherichia coli	SCR, WBC B

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2026	Logan Cr.	2763	P	6.1	36.0	Reynolds	Lead (S)	AQL
2021	Long Branch Cr.	0696	C	2	13	Macon	Oxygen, Dissolved	AQL
2016	Longview Lake	7097	L2	930	930	Jackson	Mercury (T)	AQL
2016	Lost Cr.	3278	P	8.5	8.5	Newton	Escherichia coli	WBC A
2020	M. Fk. Salt R.	123	C	11.4	25.4	Macon	Oxygen, Dissolved (W)	AQL
2020	Main Ditch	2814	C	13	13.0	Butler	pH	AQL
2020	Main Ditch	2814	C	13	13.0	Butler	Temperature (W)	AQL
2015	Maline Cr.	1709	C	0.6	0.6	St. Louis	Escherichia coli	WBC B
2018	Maline Cr.	3839	C	0.5	0.5	St. Louis	Chloride	AQL
2021	Maple Slough Ditch	3140	C	16	16	Miss/New Madrid	Oxygen, Dissolved	AQL
2016	Mark Twain Lake	7033	L2	18600	18600	Monroe/Ralls	Mercury (T)	AQL
2024	Mattese Cr.	3596	P	1.1	1.1	St. Louis	Chloride (W)	AQL
2024	Mattese Cr.	3596	P	1.1	1.1	St. Louis	Escherichia coli	WBC B
2014	Medicine Cr.	619	P	36	36	Putnam/Grundy	Escherichia coli	WBC B
2015	Meramec R.	2183	P	22	22	St. Louis	Lead (S)	AQL
2015	Meramec R.	2185	P	15.7	26	St. Louis	Lead (S)	AQL
2021	Miami Cr.	1299	P	18	18	Bates	Oxygen, Dissolved	AQL
2016	Middle Fk. Grand R.	468	P	25	25	Worth/Gentry	Escherichia coli	WBC A
2016	Middle Indian Cr.	3263	P	2.2	2.2	Newton	Escherichia coli	WBC B
2023	Middle Indian Cr.	3262	C	3.5	3.5	Newton	Aquatic Macroinvertebrate Bioassessments/Unknown	AQL
2023	Middle Indian Cr.	3263	P	2.2	2.2	Newton	Aquatic Macroinvertebrate Bioassessments/Unknown	AQL
2024	Mississippi R.	1707.03	P	44.6	44.6	St. Louis/Ste. Genevieve	Escherichia coli	WBC B
2025	Missouri R.	0226	P	179	179	Atchison/Jackson	Escherichia coli	WBC B
2025	Missouri R.	1604	P	100	100	Gasconade/St. Charles	Escherichia coli	WBC B
2025	Missouri R.	0356	P	129	129	Jackson/Saline	Escherichia coli	SCR, WBC B
2024	Monroe City Lake	7031	L1	94.0	94.0	Ralls	Mercury (T)	AQL
2016	Mozingo Lake	7402	L1	1000	1000	Nodaway	Mercury (T)	AQL
2023	Muddy Cr.	0853	P	1.8	1.8	Pettis	Aquatic Macroinvertebrate Bioassessments/Unknown	AQL
2017	Mussel Fork Cr.	0674	C	29	29	Sullivan/Macon	Escherichia coli	WBC B
2017	Niangua R.	1170	P	51	51	Webster/Dallas	Escherichia coli	WBC A
2024	Nishnabotna R.	0227	P	10.2	10.2	Atchison	Escherichia coli	WBC B
2016	No Cr.	0550	P	22.5	22.5	Grundy/Livin.	Escherichia coli	WBC B
2024	No Cr.	0550	P	22.5	22.5	Grundy/Livin.	Oxygen, Dissolved	AQL

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2016	Noblett Lake	7316	L3	26	26	Douglas	Mercury (T)	AQL
2024	Noblett Lake	7316	L3	26.0	26.0	Douglas	Chlorophyll-a (W)	AQL
2024	Noblett Lake	7316	L3	26.0	26.0	Douglas	Phosphorus, Total (W)	AQL
2019	Nodaway R.	0279	P	60	60	Nodaway	Escherichia coli	WBC B
2016	North Bethany Lake	7109	L3	78	78	Harrison	Mercury (T)	AQL
2021	North Fk. Cuivre R.	0170	C	8	8	Pike	Fecal coliform	WBC B
2014	North Fk. Spring R.	3186	P	17.4	17.4	Barton	Escherichia coli	WBC B
2014	North Fk. Spring R.	3188	C	55.9	55.9	Dade/Jasper	Escherichia coli	WBC B
2021	North Fk. Spring R.	3188	C	1.1	55.9	Barton	Ammonia, Total	AQL
2021	North Fk. Spring R.	3188	C	55.9	55.9	Dade/Jasper	Oxygen, Dissolved	AQL
2016	North Indian Cr.	3260	P	5	5	Newton	Escherichia coli	WBC B
2023	North Indian Cr.	3260	P	5.2	5.2	Newton	Aquatic Macroinvertebrate Bioassessments/Unknown	AQL
2022	Osage R.	1293	P	39.3	39.3	Vernon/St.Clair	Oxygen, Dissolved	***
2022	Panther Cr.	1373	C	7.8	7.8	St.Clair/Polk	Oxygen, Dissolved	AQL
2016	Pearson Cr.	2373	P	8.0	8.0	Greene	Escherichia coli (W)	WBC A
2016	Perry Phillips Lake	7628	U	32	32	Boone	Mercury (T)	GEN
2018	Peruque Cr.	0217	P	4	4	St. Charles	Fishes Bioassessments/Unknown	AQL
2018	Peruque Cr.	0218	C	8	10.9	St. Charles	Inorganic sediment	AQL
2023	Peruque Cr.	0216	P	0.3	10.3	St. Charles	Fishes Bioassessments/Unknown	AQL
2025	Peruque Cr.	0215	P1	9.6	9.6	St. Charles	Oxygen, Dissolved	AQL
2025	Pickle Cr.	1755	P	7	7	Ste. Genevieve	pH	AQL
2024	Pike Cr.	2815	C	6	6.0	Butler	Oxygen, Dissolved	AQL
2019	Platte R.	0312	P	138	138	Worth/Platte	Escherichia coli	WBC B
2022	Pleasant Run Cr.	1327	C	7.6	7.6	Vernon	Oxygen, Dissolved	AQL
2021	Pole Cat Slough	3120	P	12	12	Dunklin	Oxygen, Dissolved	AQL
2024	Pole Cat Slough	3120	P	12.6	12.6	Dunklin	Temperature (W)	AQL
2024	Pomme de Terre R.	1440	P	69.1	69.1	Webster/Polk	Escherichia coli	WBC A
2022	Red Oak Cr.	2038	C	10	10	Gasconade	Oxygen, Dissolved	AQL
2017	River des Peres	1710	C	2.6	2.6	St. Louis	Escherichia coli	SCR
2018	River des Peres	1710	P	2.6	2.6	St. Louis City	Oxygen, Dissolved	AQL
2018	River des Peres	1710	C	2.6	2.6	St. Louis	Chloride	AQL
2018	River des Peres	3972	U	6.5	6.5	St. Louis	Chloride	GEN
2024	Salt Cr.	0594	C	14	14.0	Livin./Chariton	Oxygen, Dissolved	AQL
2024	Salt Fk.	0893	P	13.3	26.7	Saline	Oxygen, Dissolved	AQL
2023	Salt Pine Creek	2113	C	1.2	1.2	St. Francois	Aquatic Macroinvertebrate Bioassessments/Unknown	AQL

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2016	Salt R.	0103	P1	9.3	9.3	Ralls	Mercury (T)	AQL
2022	Salt R.	0091	P	29	29	Ralls/Pike	Oxygen, Dissolved	AQL
2024	Salt R.[1]	0103	P1	9.3	9.3	Ralls	Oxygen, Dissolved	AQL
2024	Shibboleth Br.	2119	P	1.0	1.0	Washington	Lead (S)	AQL
2024	Shibboleth Br.	2119	P	1.0	1.0	Washington	Zinc (S)	AQL
2016	Shoal Cr.	3222	P	41.1	41.1	Newton	Escherichia coli	WBC A
2024	Slater Br.	3754	C	3.7	3.7	Jasper	Escherichia coli	WBC B
2021	Sni-a-bar Cr.	0399	P	32	32	Jackson/Lafayette	Oxygen, Dissolved	AQL
2018	South Blackbird Cr.	0655	C	5	13	Putnam	Ammonia	AQL
2019	South Fabius R.	0071	P	80.6	80.6	Knox/Marion	Escherichia coli	WBC B
2019	South Fk. Salt R.	0142	C	20.1	32	Callaway/Audrain	Oxygen, Dissolved	AQL
2017	South Grand R.	1249	P	62.5	62.5	Cass/Henry	Escherichia coli	WBC B
2016	South Indian Cr.	3259	P	8.7	8.7	Newton/McDonald	Escherichia coli	WBC B
2023	South Indian Cr.	3259	P	8.7	8.7	McDonald/Newton	Aquatic Macroinvertebrate Bioassessments/Unknown	AQL
2024	Spencer Cr.	0224	C	1.5	1.5	St. Charles	Chloride	AQL
2014	Spring R.	3164	P	8.8	8.8	Lawrence	Escherichia coli	WBC A
2014	Spring R.	3165	P	11.9	11.9	Lawrence	Escherichia coli	WBC A
2014	Spring R.	3160	C	61.7	61.7	Lawrence/Jasper	Escherichia coli	WBC A
2026	St. Francis R.	2835	P	8.4	93.1	St. Francois	Temperature, water	CLF
2016	St. John's Ditch	3138	P	15.3	15.3	New Madrid	Mercury (T)	AQL
2018	St. John's Ditch	3138	P	15.3	15.3	New Madrid	Escherichia coli	WBC B
2021	Stevenson Bayou	3135	C	14	14	Mississippi	Oxygen, Dissolved	AQL
2022	Straight Fk.	0959	C	2.5	6	Morgan	Oxygen, Dissolved	AQL
2020	Strother Cr.	3965	U	0.9	n/a	Reynolds/Iron	Arsenic (S)	GEN
2020	Strother Cr.	2751	P	6	6.0	Iron	Lead (S)	AQL
2020	Strother Cr.	3965	U	0.9	n/a	Reynolds/Iron	Lead (S)	GEN
2020	Strother Cr.	2751	P	6	6.0	Iron	Lead (W)	AQL
2020	Strother Cr.	2751	P	6	6.0	Iron	Nickel (S)	AQL
2020	Strother Cr.	3965	U	0.9	n/a	Reynolds/Iron	Nickel (S)	GEN
2020	Strother Cr.	2751	P	6	6.0	Iron	Zinc (S)	AQL
2020	Strother Cr.	3965	U	0.9	n/a	Reynolds/Iron	Zinc (S)	GEN
2020	Strother Cr.	2751	P	6	6.0	Iron	Zinc (W)	AQL
2020	Strother Cr.	3965	U	0.9	n/a	Reynolds/Iron	Zinc (W)	GEN
2024	Strother Cr.	2751	P	6.0	6.0	Iron/Reynolds	Aquatic Macroinvertebrate Bioassessments/Unknown	AQL
2022	Sugar Cr.	0686	P	6.8	6.8	Randolph	Oxygen, Dissolved	AQL

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2024	Sugar Creek Lake	7166	L1	308.0	308.0	Randolph	Mercury (T)	AQL
2016	Sunset Lake	7399	L3	6	6	Cole	Mercury (T)	AQL
2017	Table Rock Lake	7313	L2	41747.0	41747.0	Taney	Nutrient/Eutrophication Biol. Indicators (W)*	AQL
2017	Table Rock Lake, White River Arm	7313	L2	17240	17240	Barry/Taney	Chlorophyll	AQL
2017	Table Rock Lake, White River Arm	7313	L2	17240	17240	Barry/Taney	Nitrogen	AQL
2017	Terre Du Lac Lakes (Lac Capri)	7297	L3	103	103	St. Francois	Chlorophyll-a	AQL
2017	Terre Du Lac Lakes (Lac Capri)	7297	L3	103	103	St. Francois	Nitrogen, Total	AQL
2016	Thompson R.	0549	P	5	65	Harrison	Escherichia coli	WBC B
2016	Thurman Cr.	3243	P	3	3	Newton	Escherichia coli	WBC B
2019	Trib. to Chat Creek	3963	U	0.9	0.9	Lawrence	Cadmium (W)	GEN
2019	Trib. to Chat Creek	3963	U	0.9	0.9	Lawrence	Zinc (W)	GEN
2024	Trib. to Coon Cr.	0133	C	1	1	Randolph	Oxygen, Dissolved	AQL
2015	Trib. to Flat River Creek	3938	U	0.3	0.3	St. Francois	Zinc (W)	AQL
2020	Trib. to Goose Creek	1420	C	3	3	Lawrence	Escherichia coli	WBC B
2019	Trib. To Little Muddy Cr.	3490	C	1	1	Pettis	Chloride	AQL
2015	Trib. To Old Mines Cr.	2114	C	1.5	1.5	St. Francois	Sedimentation/Siltation	GEN
2022	Trib. To Red Oak Cr.	3360	C	0.5	0.5	Gasconade	Oxygen, Dissolved	AQL
2022	Trib. To Red Oak Cr.	3361	C	1.9	1.9	Gasconade	Oxygen, Dissolved	AQL
2024	Trib. to Shoal Cr.	3981	US	1.6	1.6	Jasper/Newton	Cadmium (W)	GEN
2024	Trib. to Shoal Cr.	3981	US	1.6	1.6	Jasper/Newton	Zinc (W)	GEN
2024	Trib. to Shoal Cr.	3982	US	2.2	2.2	Jasper/Newton	Zinc (W)	GEN
2024	Trib. to Turkey Cr.	3983	US	2.9	2.9	Jasper	Cadmium (S)	GEN
2024	Trib. to Turkey Cr.	3983	US	2.9	2.9	Jasper	Lead (S)	GEN
2024	Trib. to Turkey Cr.	3983	US	2.9	2.9	Jasper	Zinc (S)	GEN
2024	Trib. to Turkey Cr.	3983	US	2.9	2.9	Jasper	Zinc (W)	GEN
2024	Trib. to Turkey Cr.	3984	US	2.2	2.2	Jasper	Zinc (W)	GEN
2024	Trib. to Turkey Cr.	3985	US	1.6	1.6	Jasper	Zinc (W)	GEN
2022	Trib. To Willow Fk.	956	C	0.5	0.5	Moniteau	Oxygen, Dissolved	AQL
2019	Trib. To Wolf Cr.	3589	C	1.5	1.5	St. Francois	Oxygen, Dissolved	AQL
2021	Troublesome Cr.	0074	C	6.1	41.3	Knox	Oxygen, Dissolved	AQL
2014	Truitt Cr.	3175	C	6.4	6.4	Lawrence	Escherichia coli	WBC B
2014	Turkey Cr.	3216	P	7.7	7.7	Jasper	Escherichia coli	WBC B

TMDL Schedule FFY	Water Body Name	WBID	Class	Impaired Segment Size (mi/acres)	Classified Segment Size (mi/acres)	County	Pollutant	Impaired Uses
2014	Turkey Cr.	3217	P	6.1	6.1	Jasper	Escherichia coli	WBC A
2015	Turkey Cr.	3282	P	2.4	2.4	St. Francois	Cadmium (W)	AQL
2015	Turkey Cr.	3282	P	2.4	2.4	St. Francois	Lead (W)	AQL
2015	Turkey Cr.	3282	P	1.2	2.4	St. Francois	Zinc (W)	AQL
2017	Turkey Cr.	0751	C	6.3	6.3	Boone	Escherichia coli	WBC A
2017	Turkey Cr.	3216	P	7.7	7.7	Jasper	Cadmium (S)	AQL
2017	Turkey Cr.	3217	P	6.1	6.1	Jasper	Cadmium (S)	AQL
2017	Turkey Cr.	3216	P	7.7	7.7	Jasper	Cadmium (W)	AQL
2017	Turkey Cr.	3216	P	7.7	7.7	Jasper	Lead (S)	AQL
2017	Turkey Cr.	3216	P	7.7	7.7	Jasper	Zinc (S)	AQL
2017	Turkey Cr.	3217	P	6.1	6.1	Jasper	Zinc (S)	AQL
2020	Turnback Cr.	1414	P	14	14.0	Lawrence/Dade	Escherichia coli	WBC A
2020	Warm Fk. Spring R.	2579	P	13.8	13.8	Oregon	Fecal Coliform	WBC A
2014	Watkins Cr.	1708	C	3.5	3.5	St. Louis	Escherichia coli	WBC B
2018	Watkins Cr.	1708	C	3.5	3.5	St. Louis	Chloride	AQL
2016	Weatherby Lake	7071	L3	194	194	Platte	Mercury (T)	AQL
2017	Weatherby Lake	7071	L3	194	194	Platte	Chlorophyll-a	AQL
2017	Weatherby Lake	7071	L3	194	194	Platte	Nitrogen, Total	AQL
2024	Weatherby Lake	7071	L3	185.0	185.0	Platte	Phosphorus, Total (W)	AQL
2016	Weldon R.	0560	P	42	42	Mercer/Grundy	Escherichia coli	WBC B
2020	West Fk. Black R.	2755	P	2.1	32.3	Reynolds	Lead (S)	AQL
2020	West Fk. Black R.	2755	P	2.1	32.3	Reynolds	Nickel (S)	AQL
2022	West Fk. Drywood Cr.	1317	C	8.1	8.1	Vernon	Oxygen, Dissolved	AQL
2024	Whetstone Cr.	1504	P	12.2	12.2	Wright	Oxygen, Dissolved	AQL
2014	White Oak Cr.	3182	C	18	18	Lawrence/Jasper	Escherichia coli	WBC A
2015	Wildhorse Cr.	1700	C	3.9	3.9	St. Louis	Escherichia coli	WBC B
2014	Williams Cr.	3171	P	1	1	Lawrence	Escherichia coli	WBC A
2014	Williams Cr.	3172	P	8.5	8.5	Lawrence	Escherichia coli	WBC A
2015	Williams Cr.	3594	P	1	1	St. Louis	Escherichia coli	WBC B
2016	Willow Br.	3280	P	2.2	2.2	Newton	Escherichia coli	WBC B
2024	Willow Br.	3280	P	2.2	2.2	Newton	Cadmium (S)	AQL
2024	Willow Br.	3280	P	2.2	2.2	Newton	Lead (S)	AQL
2024	Willow Br.	3280	P	2.2	2.2	Newton	Zinc (S)	AQL
2022	Willow Fk.	955	C	6.5	6.5	Moniteau	Oxygen, Dissolved	AQL
2016	Wilsons Cr.	2375	P	11.9	14	Greene/Christian	Escherichia coli	WBC B
2024	Woods Fk.	2429	C	5.5	5.5	Christian	Fishes Bioassessments/Unknown	AQL

Appendix D

Lake-specific nutrient data and trophic status

Lake name	Acres	County	Years of data	ChlT (µg/L)	Secchi depth (m)	TN (µg/L)	TP (µg/L)	overall TS	NVSS (mg/L)	VSS (mg/L)
Glaciated Plains										
Baring Country Club Lake	81	Knox	9	14.1	1.17	927	27	Eutrophic	2.6	3.5
Belcher Branch Lake	42	Buchanan	7	13.9	1.04	569	37	Eutrophic	3.2	2.5
Bilby Ranch Lake	95	Nodaway	13	29.6	0.98	927	51	Eutrophic	2.5	4.8
Blind Pony Lake	96	Saline	17	31.3	0.50	1315	91	Eutrophic	5.8	5.0
Bowling Green Lake (new)	41	Pike	26	6.5	1.65	527	27	Mesotrophic	1.6	1.7
Bowling Green Lake (old)	7	Pike	12	7.0	0.95	948	70	Eutrophic	1.8	2.5
Breckenridge Lake	13	Caldwell	4	10.2	1.03	645	44	Eutrophic	1.8	3.3
Brookfield Lake	120	Linn	22	7.1	1.23	625	24	Mesotrophic	3.6	2.2
Bucklin Lake - PDW intake	17	Linn	3	24.6	0.53	1814	121	Hypereutrophic	6.9	6.2
Cameron Lake #3	92	DeKalb	12	23.2	0.61	1062	110	Eutrophic	12.7	5.0
Cameron Lake #4	173	DeKalb	11	27.3	0.63	1954	144	Hypereutrophic	11.3	5.6
Charity Lake	9	Atchison	3	15.9	1.39	598	38	Eutrophic	1.2	2.6
Concordia Lake (=Edwin A Pape Lake)	272.5	Lafayette	11	31.3	0.60	1031	67	Eutrophic	6.7	3.9
Crystal Lake	122	Ray	4	25.5	0.54	957	78	Eutrophic	10.7	5.7
Deer Ridge Community Lake	39	Lewis	22	14.0	1.19	803	42	Eutrophic	2.4	3.4
Edina Reservoir	51	Knox	12	26.0	0.55	1264	68	Eutrophic	7.0	4.3
Ella Ewing Lake	15	Scotland	10	27.0	0.60	1259	82	Eutrophic	6.2	4.1
Elmwood Lake near PDW Milan int	197	Sullivan	11	17.5	0.69	782	57	Eutrophic	4.5	3.1
Forest Lake	580	Adair	22	5.7	1.26	489	35	Mesotrophic	4.4	1.6
Fountain Grove - Jo Shelby Lake	--	Linn	4	35.4	0.81	1094	69	Eutrophic	1.8	5.7
Fox Valley Lake	89	Clark	13	8.9	1.77	664	28	Eutrophic	1.2	1.9
Green City Lake	57	Sullivan	9	28.2	0.57	1132	77	Eutrophic	5.3	5.4
Hamilton Lake	80	Caldwell	12	12.9	0.83	921	55	Eutrophic	4.6	3.0
Harrison County Lake	280	Harrison	13	38.5	0.65	1085	70	Eutrophic	3.5	5.2
Hazel Creek Lake	453	Adair	18	10.3	1.31	638	31	Eutrophic	3.9	2.4
Henry Sever Lake	158	Knox	22	14.4	0.84	1031	62	Eutrophic	3.8	3.1
Higginsville South Lake	147.1	Lafayette	22	27.1	0.54	1257	93	Eutrophic	7.7	4.1
Hunnewell Lake	228	Shelby	24	20.1	1.30	866	47	Eutrophic	3.3	3.6
Indian Creek Lake	185	Livingston	5	11.5	1.63	610	22	Eutrophic	1.0	2.3
Jacomo Lake	998	Jackson	20	15.6	1.69	513	43	Eutrophic	2.4	2.9
Jamesport City Lake	16	Daviess	3	47.2	0.62	1251	95	Hypereutrophic	2.3	7.6
Jamesport Community Lake	27	Daviess	3	111.4	0.43	1868	135	Hypereutrophic	2.7	12.8
King City New Reservoir	25.4	Gentry	3	22.0	0.70	975	71	Eutrophic	5.2	4.6
King Lake	204	DeKalb	7	17.9	0.20	1618	200	Hypereutrophic	28.0	6.1

La Plata Lake (new)	81	Macon	6	14.4	1.09	828	31	Eutrophic	3.1	3.1
LaBelle Lake #2	98	Lewis	9	40.1	0.86	1230	71	Hypereutrophic	2.0	6.0
Lake #33 (Busch Wildlife Area)	164	St. Charles	23	60.7	0.47	1156	103	Hypereutrophic	5.6	8.8
*Lake #37 (Busch Wildlife Area)	--	St. Charles	3	7.8	1.17	471	26	Mesotrophic	3.2	1.9
Lake Allaman	6	Clinton	8	11.8	1.13	609	38	Eutrophic	3.0	3.4
Lake Contrary	291	Buchanan	5	223.4	0.18	3291	393	Hypereutrophic	17.2	30.9
Lake Marie	60	Mercer	10	3.5	2.69	449	16	Mesotrophic	1.6	1.4
Lake Nehai Tonkayea	228	Chariton	10	2.5	1.75	417	16	Mesotrophic	2.8	1.1
Lake Paho	273	Mercer	11	12.9	0.70	845	47	Eutrophic	5.8	2.9
Lake Showme	214	Scotland	3	26.8	1.12	962	40	Eutrophic	1.6	5.3
Lake St. Louis	444	St. Charles	18	24.8	0.50	1045	73	Eutrophic	10.3	5.2
Lake Ste. Louise	71	St. Charles	13	7.9	1.03	506	34	Mesotrophic	4.1	1.7
Lake Tapawingo	83	Jackson	14	24.2	1.45	720	38	Eutrophic	2.1	4.6
Lake Thunderhead	859	Putnam	12	14.7	0.64	947	49	Eutrophic	6.5	2.9
Lake Viking	552	Daviess	23	8.5	1.39	513	32	Mesotrophic	3.2	1.8
Lakewood Lake	279	Jackson	5	16.1	1.24	586	34	Eutrophic	3.0	2.8
Lancaster City Lake (new)	56	Schuyler	8	31.8	0.70	951	72	Eutrophic	3.1	5.6
Lawson City Lake	25	Ray	4	23.0	0.83	903	33	Eutrophic	3.8	4.7
Limpp Lake	27	Gentry	3	70.5	0.35	1592	115	Hypereutrophic	11.4	15.9
Lincoln Lake (Cuivre River SP)	88	Lincoln	24	4.8	2.11	445	18	Mesotrophic	1.3	1.7
Long Branch Lake	2686	Macon	24	13.0	0.70	929	52	Eutrophic	6.5	3.2
Longview Lake	953	Jackson	25	9.5	1.14	647	35	Eutrophic	5.7	2.5
Lotawana Lake	487	Jackson	15	13.5	1.79	589	36	Eutrophic	1.8	1.9
Macon City Lake	189	Macon	13	23.9	0.78	878	50	Eutrophic	4.2	3.9
Maple Leaf Lake	127	Lafayette	9	18.7	1.08	814	38	Eutrophic	2.6	3.1
Marceline City Lake (new)	200	Chariton	15	33.2	0.78	1142	86	Eutrophic	4.5	5.9
Marceline City Lake (old)	68	Linn	3	19.8	0.69	976	72	Eutrophic	7.7	4.2
Mark Twain Lake	18132	Ralls	24	14.6	1.05	1233	66	Eutrophic	3.3	2.7
Maysville Lake #1	27	DeKalb	11	39.2	0.58	1292	170	Hypereutrophic	5.1	6.1
Memphis Lake #1	39	Scotland	12	40.0	0.59	1215	78	Hypereutrophic	7.1	7.2
Milan Lake (new)	37	Sullivan	11	11.6	0.83	681	46	Eutrophic	4.2	2.8
Monroe City Lake	94	Ralls	3	28.4	0.57	1205	96	Eutrophic	4.3	4.7
Monroe City Lake B	55	Monroe	13	31.3	0.47	1155	81	Eutrophic	8.1	5.9
Mozingo Lake	898	Nodaway	13	17.2	1.44	832	32	Eutrophic	1.8	2.3
Nodaway Lake	73	Nodaway	13	23.1	0.81	1025	45	Eutrophic	4.7	4.3
North Bethany City Reservoir	78	Harrison	11	8.0	1.30	688	30	Eutrophic	3.5	2.5
Odessa Lake	87	Lafayette	4	21.4	1.15	859	39	Eutrophic	1.3	3.6
Pony Express Lake	240	DeKalb	13	27.3	0.73	1052	63	Eutrophic	4.2	4.4
Prairie Lee Lake	144	Jackson	16	20.3	0.84	868	51	Eutrophic	4.7	3.9
Ray County Community Lake	23	Ray	4	123.5	0.39	2000	159	Hypereutrophic	5.0	12.9
Riss Lake (Parkville)	--	Platte	3	3.3	4.41	353	12	Mesotrophic	1.9	1.5

Rocky Hollow Lake	20	Clay	11	30.1	0.54	932	80	Eutrophic	7.7	5.0
Rothwell Lake	27	Randolph	13	23.0	1.49	877	51	Eutrophic	2.3	4.7
*Santa Fe Lake	--	Macon	3	25.0	0.99	968	43	Eutrophic	1.6	5.3
Savannah City Reservoir	20	Andrew	4	23.3	0.99	898	47	Eutrophic	3.6	4.3
Shelbina Lake	45	Shelby	10	33.1	0.57	1077	95	Eutrophic	6.7	5.8
Smithville Lake	7190	Clay	25	16.4	0.97	896	37	Eutrophic	4.5	3.2
Spring Lake	87	Adair	9	7.2	1.05	557	34	Eutrophic	4.1	2.1
Sterling Price Lake	23	Chariton	8	62.5	0.56	1454	101	Hypereutrophic	4.2	10.4
Sugar Creek Lake	308	Randolph	23	19.6	1.10	795	53	Eutrophic	5.5	3.9
Sugar Lake, east end (Lewis & Clark SP)	403	Buchanan	5	161.3	0.18	2432	341	Hypereutrophic	36.3	22.4
Thomas Hill Reservoir	4400	Randolph	14	13.8	0.51	761	51	Eutrophic	7.6	2.5
Unionville Lake (new)	74	Putnam	20	31.4	0.49	1229	106	Hypereutrophic	7.6	5.4
Vandalia Community Lake	35	Audrain	13	28.6	0.81	1058	68	Eutrophic	2.4	4.9
Wakonda Lake near boat ramp	78	Lewis	5	45.0	0.77	1187	89	Eutrophic	3.3	7.6
Water Works Lake	22	Randolph	11	26.1	1.46	909	49	Eutrophic	2.5	4.8
Watkins Mill Lake	87	Clay	26	18.0	1.09	651	40	Eutrophic	4.4	3.5
Waukomis Lake	76	Platte	20	8.1	1.93	561	22	Mesotrophic	2.1	2.1
Weatherby Lake	185	Platte	16	5.5	2.83	409	19	Mesotrophic	1.7	1.9
Whiteside Lake	28	Lincoln	4	7.2	2.14	665	22	Mesotrophic	0.6	1.6
Willow Brook Lake	53	DeKalb	5	34.6	0.64	1155	80	Eutrophic	6.1	6.2
Worth County Lake	17	Worth	3	40.1	0.57	1357	73	Hypereutrophic	3.2	7.8
Osage Plains										
Amarugia Highlands Lake	39	Cass	10	10.1	0.99	646	45	Eutrophic	4.7	2.5
Atkinson Lake	434	St. Clair	24	34.0	0.50	1037	75	Eutrophic	8.8	5.7
Blue Springs Lake	642	Jackson	23	16.5	1.53	532	36	Eutrophic	3.4	3.5
Bushwhacker Lake	148	Vernon	5	12.2	1.19	606	29	Eutrophic	2.0	2.7
Butler Lake	71	Bates	6	35.2	0.64	951	67	Eutrophic	4.3	6.0
Catclaw Lake	42	Jackson	4	15.8	0.40	1057	108	Eutrophic	13.0	7.0
Coot Lake	20	Jackson	4	25.8	0.51	1123	59	Eutrophic	5.5	6.3
Cottontail Lake	22	Jackson	6	21.5	0.42	833	85	Eutrophic	12.0	5.6
Gopher Lake	38	Jackson	6	30.1	0.47	831	86	Eutrophic	6.6	5.9
Harmony Mission Lake	96	Bates	9	21.1	0.98	814	47	Eutrophic	2.3	2.7
Harrisonville Lake	419	Cass	9	17.7	0.84	912	51	Eutrophic	5.2	3.3
Hazel Hill Lake	62	Johnson	13	34.1	0.72	1039	50	Eutrophic	3.7	5.3
Holden City Lake	290.2	Johnson	9	14.7	0.70	843	44	Eutrophic	5.7	3.0
HS Truman Reservoir	55600	Benton	23	15.5	1.18	751	43	Eutrophic	3.2	2.4
Jackrabbit Lake	25	Jackson	4	13.1	0.70	763	97	Eutrophic	6.6	4.0
Lake of the Woods-KC	7	Jackson	4	50.9	0.90	897	106	Hypereutrophic	8.9	7.2
Lake Winnebago	272	Cass	8	18.9	0.87	794	47	Eutrophic	5.0	2.8
Lamar City Lake	148	Barton	20	42.6	1.16	1091	82	Eutrophic	2.1	5.6
Lone Jack Lake	31	Jackson	3	15.3	1.62	646	28	Eutrophic	1.0	2.8

Montrose Lake	1444	Henry	11	57.7	0.29	1265	189	Hypereutrophic	43.0	12.1
Nell Lake	24	Jackson	4	28.8	0.51	1187	88	Eutrophic	6.9	5.7
North Lake	19	Cass	24	40.4	0.64	1079	103	Hypereutrophic	5.2	5.8
Penn Valley Park Lake	--	Jackson	4	38.0	0.67	1025	104	Eutrophic	18.2	10.3
Raintree Lake	248.1	Cass	22	12.7	0.62	835	55	Eutrophic	7.1	3.2
Spring Fork Lake	178	Pettis	19	44.0	0.62	1317	165	Hypereutrophic	5.6	6.2
Westmoreland Lake	--	Pettis	6	4.7	2.25	616	19	Mesotrophic	0.6	1.7
Ozark Border										
*Alpine Lake (Innsbrook)	--	Warren	7	1.7	5.81	311	6	Oligotrophic	0.8	0.7
Ashland Lake	--	Boone	10	39.7	0.73	1446	123	Hypereutrophic	5.2	6.7
Aspen Lake (Innsbrook)	--	Warren	7	7.0	2.39	514	22	Mesotrophic	2.0	1.8
Bella Vista Lake	--	Cape Girardeau	9	7.6	1.49	515	24	Mesotrophic	1.7	1.9
Ben Branch Lake	37	Osage	7	10.3	1.76	648	21	Eutrophic	0.8	2.4
*Bennett Lake	--	Howard	3	10.5	1.39	637	23	Eutrophic	1.3	2.0
Binder Lake	127	Cole	25	28.8	0.93	822	58	Eutrophic	2.9	5.0
*Castlenovo Lake (Innsbrook)	--	Warren	6	3.6	3.06	446	22	Mesotrophic	1.4	1.2
Creve Coeur Lake	327	St. Louis	19	47.8	0.63	866	128	Hypereutrophic	16.1	8.3
DC Rogers Lake	195	Howard	12	7.8	0.99	550	35	Eutrophic	3.7	1.8
Fayette Lake #2 (=Peters Lake)	62	Howard	9	18.3	0.73	812	48	Eutrophic	4.6	3.9
*Foxtail Lake (Innsbrook)	--	Warren	7	17.4	1.23	769	60	Eutrophic	4.0	3.6
Glover Spring Lake	23	Callaway	7	15.3	1.12	876	59	Eutrophic	3.7	4.4
Goose Creek Lake	308.3	Ste. Genevieve	11	3.2	2.38	391	14	Mesotrophic	1.3	1.1
Higbee City Lake	--	Randolph	3	14.3	1.02	699	41	Eutrophic	1.8	3.7
Higbee Lake	13	Randolph	3	8.0	1.41	640	27	Eutrophic	2.2	2.3
Innsbrook Lake	--	Warren	7	8.0	1.80	562	29	Eutrophic	2.8	2.1
*January Wabash Lake	--	St. Louis	3	59.3	0.48			Hypereutrophic		
*Jennings Lake	--	St. Louis	11	25.9	1.18	1045	246	Eutrophic	4.2	7.2
Lake Boutin (Trail of Tears SP)	--	Cape Girardeau	9	9.1	1.45	645	26	Eutrophic	1.6	2.5
Lake Eleanor, Sherwood Lakes	--	Warren	5	17.8	1.42	762	43	Eutrophic	1.8	4.1
Lake Forest (=Lake Anne)	81	Ste. Genevieve	11	16.4	1.36	642	40	Eutrophic	1.5	3.2
Lake Girardeau	144	Cape Girardeau	9	30.9	1.05	794	48	Eutrophic	1.9	5.8
*Lake Konstanz	--	Warren	7	1.7	3.68	298	7	Oligotrophic	1.6	0.8
Lake Lucern (Innsbrook)	41	Warren	9	7.8	1.75	579	26	Eutrophic	1.7	2.2
Lake Tishomingo	115	Jefferson	19	7.8	2.01	545	20	Mesotrophic	1.4	2.0
Lake Wanda Lee	97	Ste. Genevieve	10	16.3	1.57	566	43	Eutrophic	2.2	3.2
Lake Wauwanoka	93	Jefferson	14	2.6	2.86	382	13	Mesotrophic	1.5	0.9
*Lick Creek Lake	--	Boone	5	16.5	1.77	656	34	Eutrophic	1.5	2.9
Little Dixie Lake	176	Callaway	23	25.5	0.80	896	62	Eutrophic	4.5	4.1
Manito Lake	77	Moniteau	13	15.2	0.52	1017	102	Eutrophic	5.3	2.5
Perry County Community Lake	89	Perry	9	40.3	0.81	1015	81	Eutrophic	2.4	6.3
Phillips Lake	32	Boone	5	15.9	1.47	695	40	Eutrophic	2.7	3.1
Pinnacle Lake	115	Montgomery	5	3.7	2.41	455	18	Mesotrophic	1.5	1.3
Prairie Home CA Lake #2	--	Cooper	3	9.9	0.98	673	31	Eutrophic	2.3	2.9

*Quarry Heights Lake	--	Boone	6	14.6	2.61	498	39	Eutrophic	0.9	3.5
*Red Fox Lake (Innsbrook)	--	Warren	5	9.3	1.27	764	54	Eutrophic	3.5	2.0
Robin Hood Lakes, Sherwood Lakes	--	Warren	5	29.5	1.23	1006	63	Eutrophic	2.3	5.2
Rocky Fork Lake	60	Boone	8	5.7	1.68	474	18	Mesotrophic	1.6	1.7
Sherwood Lake	120	Warren	6	5.2	3.46	482	15	Mesotrophic	0.6	1.6
*Simpson Park Lake	--	St. Louis	7	39.6	1.12	768	69	Eutrophic	4.9	6.1
St. Gallen Lake (Innsbrook)	--	Warren	4	4.8	1.59	423	20	Mesotrophic	1.4	1.6
*Stephens Lake	--	Boone	4	7.2	1.50	535	35	Mesotrophic	4.0	2.6
Sugar Hollow Lake, Sherwood Lakes	--	Warren	5	15.5	1.48	864	39	Eutrophic	1.7	3.4
*Tri-City Lake	--	Boone	19	26.9	0.85	1006	61	Eutrophic	4.5	4.6
Tywappity Community Lake	43	Scott	8	40.5	0.68	1142	55	Eutrophic	1.7	6.5
*UMC Dairy Lake #1	--	Boone	6	86.1	0.41	2221	214	Hypereutrophic	5.7	13.0
UMC Dairy Lake #3	--	Boone	4	56.2	0.50	1740	363	Hypereutrophic	3.6	6.5
Wanderfern Lake (Innsbrook)	--	Warren	7	6.8	2.38	505	21	Mesotrophic	1.8	1.9
*Whippoorwill Lake (Innsbrook)	--	Warren	6	3.3	2.69	495	20	Mesotrophic	1.3	1.1
*Whitecliff Park Lake	--	St. Louis	8	18.1	2.42	765	36	Eutrophic	1.0	4.4
Ozark Highlands										
Austin Community Lake	21	Texas	12	7.2	1.40	576	21	Mesotrophic	1.1	2.3
Bismarck Lake (=Hematite, DiSalvo)	210	St. Francois	13	12.6	1.29	514	36	Eutrophic	1.2	2.8
Bull Shoals Lake @ Mile 32.4	9000	Taney	11	6.6	2.32	323	13	Mesotrophic		
Clearwater Lake	1635	Wayne	25	5.9	1.53	222	17	Mesotrophic	2.4	1.3
Council Bluff Lake	423	Iron	24	2.3	3.34	221	10	Oligotrophic	0.7	0.7
Crane Lake	109	Iron	8	3.9	1.30	224	14	Mesotrophic	2.2	1.5
Fellows Lake	800	Greene	23	5.6	3.03	387	16	Mesotrophic	0.9	1.7
Fourche Creek Lake	49	Ripley	12	2.4	2.92	270	9	Oligotrophic	0.8	1.1
Fredericktown City Lake	80	Madison	8	29.0	0.77	711	64	Eutrophic	4.3	4.6
Indian Hills Lake	279	Crawford	13	15.3	0.98	628	36	Eutrophic	2.4	3.0
Lac Carmel (Terre du Lac Lakes)	--	St. Francois	11	1.8	2.86	322	8	Oligotrophic	1.0	0.7
Lake Capri (Terre du Lac Lakes)	--	St. Francois	23	1.5	4.78	290	6	Oligotrophic	0.5	0.7
Lake Killarney	61	Iron	7	24.3	0.85	568	51	Eutrophic	3.3	4.2
Lake Marseilles (Terre du Lac Lakes)	--	St. Francois	10	2.0	3.58	343	10	Oligotrophic	0.6	0.9
Lake of the Ozarks	59520	Miller	18	13.0	1.65	590	31	Eutrophic	2.0	2.4
Lake Shayne (Terre du Lac Lakes)	--	Washington	22	1.2	3.13	263	7	Oligotrophic	1.1	0.7
Lake Springfield	293	Greene	12	23.8	0.82	1014	49	Eutrophic	10.3	4.0
Lake Taneycomo	2118.6	Taney	20	5.7	2.25	700	22	Mesotrophic	12.3	
Lake Wappapello	8200	Wayne	26	25.6	0.97	631	43	Eutrophic	4.1	5.1
Little Prairie Lake	95	Phelps	24	7.8	1.35	467	27	Mesotrophic	3.0	1.8
Loggers Lake	21	Shannon	8	2.7	3.17	207	8	Oligotrophic	0.5	0.9
Lower Taum Sauk Reservoir	200	Reynolds	9	3.3	2.20	184	11	Mesotrophic	1.7	1.1
Mac (=Ziske) Lake	28	Dent	10	11.9	1.61	610	28	Eutrophic	1.4	2.8
McCormack Lake	9	Oregon	3	0.7	3.30	96	5	Oligotrophic	0.4	0.4
McDaniel Lake	218	Greene	20	15.1	1.30	475	33	Eutrophic	1.7	3.1
Miller Community Lake	--	Carter	11	6.6	1.36	517	20	Mesotrophic	1.3	2.6

Monsanto Lake (St. Joe SP)	18	St. Francois	10	2.1	2.07	381	10	Mesotrophic	1.2	1.0
Noblett Lake	26	Douglas	10	2.2	2.48	187	12	Oligotrophic	0.6	0.8
Norfork Lake at Tecumseh	1000	Ozark	6	3.5	1.76	625	22	Mesotrophic	3.3	1.5
Northwoods Lake	77	Gasconade	13	3.8	1.43	441	21	Mesotrophic	2.6	1.4
Peaceful Valley Lake	158	Gasconade	14	18.6	1.38	769	33	Eutrophic	1.4	3.3
Pinewoods Lake	22	Carter	9	10.5	1.39	593	28	Eutrophic	0.7	3.2
Pomme de Terre Lake	7820	Hickory	23	14.5	1.63	582	32	Eutrophic	1.2	2.5
Ripley County Lake	18	Ripley	9	10.1	1.71	625	24	Eutrophic	0.8	3.2
Roby Lake	10	Texas	9	3.3	1.97	427	15	Mesotrophic	0.9	1.2
Shawnee (=Turner) Lake	15	Dent	9	8.1	1.60	522	20	Mesotrophic	1.0	2.1
Sims Valley Lake	42	Howell	10	11.6	1.18	511	26	Eutrophic	1.4	3.2
Stockton Lake	23680	Cedar	25	6.7	2.73	432	12	Mesotrophic	1.2	1.5
Sunnen Lake	206	Washington	14	3.3	2.49	297	12	Mesotrophic	1.2	0.9
Table Rock Lake	41747	Stone	26	4.9	3.46	450	10	Mesotrophic	0.7	1.5
Timberline Lakes - large lake	--	St. Francois	12	1.4	4.04	283	9	Oligotrophic	0.6	0.5

APPENDIX E – Other Waters Rated as Impaired and Believed to be Impaired

The following list includes classified waters in Missouri found to be impaired, but which do not qualify for Section 303(d) listing. This list includes waters with approved TMDLs, waters where sufficient pollution control measures are in place, waters which are impaired by measures other than discrete pollutants, and other waters which were not approved for 303(d) listing by the Clean Water Commission.

WBID	Waterbody	Imp. Size (mi.)	County	Cause	Source	Category
1746	Big Bottom Cr. (C)	1.5	Ste. Genevieve	Ammonia, Total	Municipal PSD	4A
1746	Big Bottom Cr. (C)	1.5	Ste. Genevieve	Low Dissolved Oxygen	Municipal PSD	4A
2074	Big R. (P)	55.6	Jefferson	Lead (sediment)	Mill Tailings	4A
3118	Buffalo Ditch (P)	17.3	Dunklin	Low Dissolved Oxygen	Source Unknown	4A
3941	Cave Spring Br. (US)	0.4	Jasper	Nitrogen, Total	Industrial PSD	4A
640	Chariton R. (P)	111.0	Putnam/Chariton	Escherichia coli	Rural NPS	4A
3168	Chat Cr. (C)	2.1	Lawrence	Zinc (W)	Subsurface, Hardrock, Mining	4A
1145	Dry Auglaize Cr. (P)	7.6	Laclede	Cause Unknown	Source Unknown	4B
1145	Dry Auglaize Cr. (P)	7.6	Laclede	Low Dissolved Oxygen	Source Unknown	4B
811	E. Brush Cr. (C)	9.0	Moniteau	Low Dissolved Oxygen	Municipal PSD	4B
2737	E. Fk. Black R. (P)	17.1	Reynolds	Aquatic Inv. Bioassessments	Dam or Impoundment	4C
883	Gabriel Cr. (C)	13.6	Morgan	Low Dissolved Oxygen	Municipal PSD	4B
430	Grand R. (P)	127.5	Gentry	Fishes Bioassessments	Channelization	4C
2681	Jacks Fk. (P)	61.6	Shannon	Escherichia coli	Recreational Pollution Sources; Municipal PSD	4A
3233	Joyce Cr. (C)	4.5	Barry	Escherichia coli	Rural NPS	4A
1438	L. Lindley Cr. (C)	3.7	Dallas	Aquatic Inv. Bioassessments	Source Unknown	4B
1381	L. Sac R. (P)	37.0	Greene/Polk	Escherichia coli	Nonpoint Source; Agriculture	4A
7314	Lake Taneycomo (L2)	2119 ac.	Taney	Dissolved oxygen saturation	Dam or Impoundment	4A
7356	Lamar Lake (L1)	148 ac.	Barton	Nutrient/Eutrophication Biological Indicators	Rural NPS	4A
857	Long Br. (C)	6.0	Johnson/Pettis	Cause Unknown	Source Unknown	4A
857	Long Br. (C)	6.0	Johnson/Pettis	Low Dissolved Oxygen	Source Unknown	4A
1308	Marmaton R. (P)	35.7	Vernon	Low Dissolved Oxygen	Rural NPS	4A
2786	McKenzie Cr. (P)	6.3	Wayne	Low Dissolved Oxygen	Municipal PSD	4B
2787	McKenzie Cr. (P)	4.7	Wayne	pH	Source Unknown	4A
1284	Middle Fk. Tebo Cr. (C)	7.5	Henry	Total Dissolved Solids	Coal Mining	4A
1234	Monegaw Cr. (C)	18.4	St. Clair	Total Dissolved Solids	Coal Mining	4A
1300	Mound Br. (C)	8.9	Bates	Dissolved oxygen saturation	Source Unknown	4A
56	N. Fabius R. (P)	92.0	Clark/Lewis	Fishes Bioassessments	Channelization	4C
942	N. Moreau Cr. (P)	47.9	Moniteau	Low Dissolved Oxygen	Source Unknown	4A
1031	Osage R. (P)	81.9	Miller	Aquatic Inv. Bioassessments	Dam or Impoundment	4C
1387	Pea Ridge Cr. (P)	1.5	Greene	Aquatic Inv. Bioassessments	Source Unknown	4C
1444	Piper Cr. (P)	5.3	Polk	Aquatic Inv. Bioassessments	Source Unknown	4A
3232	Pogue Cr. (C)	2.5	Barry	Escherichia coli	Rural NPS	4A
2128	Pond Cr. (C)	1.0	Washington	Sedimentation/Siltation	Mill Tailings	4A
2128	Pond Cr. (C)	1.0	Washington	Zinc (W)	Mill Tailings	4A
71	S. Fabius R. (P)	80.6	Knox/Lewis/ Marion/Shelby	Fishes Bioassessments	Channelization	4C

WBID	Waterbody	Imp. Size (mi.)	County	Cause	Source	Category
2859	Saline Cr. (P)	5.8	Madison	Nickel (W)	Mine Tailings	4A
1319	Second Nicolson Cr. (P)	4.5	Barton	Sulfates	Acid Mine Drainage	4A
2170	Shaw Br. (C)	1.2	St. Francois	Lead (S)	Mill Tailings	4A
2120	Shibboleth Br. (C)	3.0	Washington	Lead (S)	Mill Tailings	4A
2120	Shibboleth Br. (C)	3.0	Washington	Zinc (S)	Mill Tailings	4A
3230	Shoal Cr. (P)	15.7	Barry/Newton	Fecal Coliform	Rural NPS	4A
1870	Spring Cr. (P)	18.0	Dent	Low Dissolved Oxygen	Municipal PSD	4A
1870	Spring Cr. (P)	18.0	Dent	Solids, Suspended/Bedload	Municipal PSD	4A
710	Stinson Cr. (C)	11.9	Callaway	Low Dissolved Oxygen	Municipal PSD; Natural Conditions	4A
3822	Town Br. (P)	2.5	Polk	Cause Unknown	Source Unknown	4A
3822	Town Br. (P)	2.5	Polk	Total Suspended Solids	Municipal PSD	4A
2850	Trace Cr. (C)	6.2	Madison	pH	Natural Sources	4A
1288	Trib. M. Fk. Tebo Cr. (C)	3.1	Henry	pH	Coal Mining	4A
1288	Trib. M. Fk. Tebo Cr. (C)	3.1	Henry	Total Dissolved Solids	Coal Mining	4A
3940	Trib. to Big Cr. (US)	1.6	Iron	Cadmium (W)	Ind./Comm. Site Strmwtr Disch, Permitted	4A
3940	Trib. to Big Cr. (US)	1.6	Iron	Zinc (W)	Ind./Comm. Site Strmwtr Disch, Permitted	4A
1225	Trib. to Big Otter Cr. (C)	1.0	Henry	pH	Coal Mining	4A
3663	Trib. to Indian Cr. (C)	0.3	Washington	Lead (W)	Subsurface, Hardrock, Mining	4A
2863	Village Cr. (P)	1.9	Madison	Sedimentation/Siltation	Mill Tailings	4A
613	W. Fk. Locust Cr. (C)	17.0	Sullivan	Aquatic Inv. Bioassessments	Source Unknown	4A
613	W. Fk. Locust Cr. (C)	17.0	Sullivan	Low Dissolved Oxygen	Source Unknown	4A
400	W. Fk. Sni-a-bar Cr. (P)	9.0	Jackson	Low Dissolved Oxygen	Municipal PSD	4A
7009	Wyaconda Lake (L1)	9 ac.	Clark	Atrazine	Crop Production,Crop Land or Dry Land	4A

PSD = Point Source Discharge; NPS = Nonpoint Source; S = Sediment; T= Fish Tissue; W = Water

Appendix F - Potentially Impaired Waters

The following waters are those for which there is some indication that an impairment to some designated use may exist, but the current data or information indicating the impairment do not meet the data requirements set out by Missouri's Section 303(d) Listing Methodology. The Department will make an effort to conduct further monitoring on these waters in order to determine defensibly whether these impairments actually exist.

WBID	Waterbody Name	Size (mi./ac.)	Potential Pollutant or Condition	Category
2809	Ackerman Ditch	14.1	Habitat Degradation	3B
334	Agee Cr.	4.8	Habitat Degradation	3B
2093	Allen Br.	1.8	Fish Bioassessments/Unknown	3B
1799	Apple Cr.	44.8	Aquatic Macroinvertebrate Bioassessments/Unknown	2B
282	Arapahoe Cr.	8.0	Habitat Degradation	3B
2880	Back Cr.	3.8	Low Dissolved Oxygen	3B
2656	Barren Fk.	2.0	Fish Bioassessments/Unknown	3B
148	Bean Br.	8.7	Habitat Degradation	3B
7068	Bean Lake	420.0	Nutrients	3B
272	Bear Cr.	9.8	Habitat Degradation	3B
416	Bear Cr.	4.5	Habitat Degradation	3B
115	Bear Cr.	36.2	Habitat Degradation	3B
193	Bear Cr.	16.1	Habitat Degradation	3B
1015	Bear Cr.	6.0	Fish Bioassessments/Unknown	3B
3265	Beaver Br.	2.0	Aquatic Macroinvertebrate Bioassessments/Unknown	3B
3267	Beaver Br.	1.5	Aquatic Macroinvertebrate Bioassessments/Unknown	3B
3266	Beaver Br.	3.5	Aquatic Macroinvertebrate Bioassessments/Unknown	3B
1509	Beaver Cr.	5.7	Fish Bioassessments/Unknown	3B
145	Beaver Dam Cr.	5.0	Habitat Degradation	3B
137	Bee Cr.	5.8	Habitat Degradation	3B
273	Bee Cr.	29.4	Habitat Degradation	3B
3966	Bee Fk.	5.9	Heavy Metals in Sediment	2B
2179	Belew Cr.	7.0	Fish bioassessments/Unknown and Low Dissolved Oxygen	3B
220	Belleau Cr.	5.1	Habitat degradation	3B
205	Big Cr.	10.3	Habitat Degradation	3B
2647	Big Cr.	23.0	Fish and Aquatic Macroinvertebrate Bioassessments/Unknown	3B
207	Big Cr.	17.7	Habitat Degradation	2B
180	Big Lead Cr.	5.0	Habitat Degradation	3B
441	Big Muddy Cr.	12.0	Habitat Degradation	3B
462	Big Muddy Cr.	10.9	Habitat Degradation	3B
461	Big Muddy Cr.	10.2	Habitat Degradation	3B
465	Big Rock Cr.	5.9	Habitat Degradation	3B
464	Big Rock Cr.	3.7	Habitat Degradation	3B
1608	Bigelow's Cr.	5.0	Low Dissolved Oxygen	3B
124	Billys Br.	11.5	Habitat Degradation	3B
112	Black Cr.	21.8	Low Dissolved Oxygen	2B
2807	Black R. Ditch	11.1	Habitat Degradation	3B
891	Blackwater R.	79.4	Habitat Degradation	3B
421	Blue R.	12.0	Bacteria	2B
1983	Brazil Cr.	13.9	Aquatic Macroinvertebrate Bioassessments/Unknown	3B
70	Bridge Cr.	27.0	Habitat Degradation	3B
66	Bridge Cr.	8.4	Habitat Degradation	3B
2056	Brush Cr.	2.0	Fish Bioassessments/Unknown	3B
276	Brush Cr.	7.4	Habitat Degradation	3B
192	Brush Cr.	7.8	Habitat Degradation	3B
107	Brush Cr.	3.4	Habitat Degradation	3B
408	Brush Cr.	5.9	Habitat Degradation	3B
531	Brushy Cr.	8.1	Habitat Degradation	3B
438	Brushy Cr.	5.4	Habitat Degradation	3B
395	Brushy Cr.	2.2	Habitat Degradation	3B
167	Brushy Cr.	3.0	Habitat Degradation	3B

WBID	Waterbody Name	Size (mi./ac.)	Potential Pollutant or Condition	Category
377	Brushy Cr.	7.0	Habitat Degradation	3B
336	Brushy Cr.	12.1	Habitat Degradation	3B
69	Brushy Cr.	4.5	Habitat Degradation	3B
2422	Bull Cr.	5.0	Temperature	2B
3264	Bullskin Cr.	4.9	Fish Bioassessments/Unknown	2B
363	Burr Oak Cr.	2.0	Habitat Degradation	3B
203	Butcher Cr.	1.0	Habitat Degradation	3B
1606	Callaway Fk.	4.5	Fish Bioassessments/Unknown	3B
198	Camp Br.	4.0	Habitat Degradation	3B
2431	Camp Cr.	1.0	Fish Bioassessments/Unknown	3B
197	Camp Cr.	6.0	Habitat Degradation	3B
196	Camp Cr.	6.3	Habitat Degradation	3B
491	Campbell Cr.	2.8	Habitat Degradation	3B
2820	Cane Cr. Ditch	7.5	Habitat Degradation	3B
2560	Caney Cr.	7.0	Aquatic Macroinvertebrate Bioassessments/Unknown	3B
389	Carroll Cr.	9.4	Habitat Degradation	3B
209	Casmer Br.	1.5	Habitat Degradation	3B
322	Castile Cr.	40.2	Low Dissolved Oxygen	2B
476	Chapman Br.	1.9	Habitat Degradation	3B
7048	City Lake #2 - Perry	7.0	Atrazine	3B
433	Clear Cr.	6.0	Habitat Degradation	3B
292	Clear Cr.	13.0	Habitat Degradation	3B
117	Clear Cr.	4.7	Habitat Degradation	3B
390	Clear Cr.	13.5	Habitat Degradation	3B
388	Clear Cr.	5.0	Habitat Degradation	3B
2082	Clear Cr.	4.4	Fish Bioassessments/Unknown	3B
225	Cole Cr.	5.7	Habitat Degradation	2B
269	Contrary Cr.	10.0	Mercury in Fish Tissue	3B
1459	Contrary Cr.	4.5	Fish Bioassessments/Unknown	3B
208	Coon Cr.	9.2	Habitat Degradation	3B
187	Coon Cr.	13.2	Habitat Degradation	3B
132	Coon Cr.	11.8	Low Dissolved Oxygen	2B
527	Cottonwood Cr.	4.3	Habitat Degradation	3B
410	Cottonwood Cr.	3.9	Habitat Degradation	3B
1947	Courtois Cr.	1.7	Aquatic Macroinvertebrate Bioassessments/Unknown	3B
247	Cow Br.	4.4	Habitat Degradation	3B
536	Crabapple Cr.	3.8	Habitat Degradation	3B
188	Crooked Cr.	4.0	Habitat Degradation	3B
333	Crooked Cr.	4.0	Habitat Degradation	3B
330	Crooked Cr.	2.8	Habitat Degradation	3B
201	Crooked Cr.	1.5	Habitat Degradation	3B
371	Crooked R.	58.1	Habitat Degradation	3B
376	Crooked R.	7.5	Habitat Degradation	3B
152	Cuivre R.	30.0	Bacteria	2B
2662	Current R.	18.8	Mercury in Fish Tissue	2B
443	Cypress Cr.	15.8	Habitat Degradation	3B
2616	Cypress Ditch #1	9.7	Habitat Degradation	3B
255	Davis Cr.	3.5	Habitat Degradation	3B
144	Davis Cr.	8.8	Low Dissolved Oxygen	3B
253	Davis Cr. Ditch	6.7	Habitat Degradation	3B
539	Dead Oak Br.	1.0	Habitat Degradation	3B
320	Dicks Cr.	7.3	Habitat Degradation	3B
268	Dillon Cr.	4.8	Aquatic Macroinvertebrate Bioassessments/Unknown	3B
2998	Ditch #10	3.5	Mercury in Fish Tissue	3B
3812	Ditch #11	3.0	Habitat Degradation	3B
3813	Ditch #16	11.2	Habitat Degradation	3B
2617	Ditch #2	3.2	Habitat Degradation	3B

WBID	Waterbody Name	Size (mi./ac.)	Potential Pollutant or Condition	Category
2618	Ditch #2	6.0	Habitat Degradation	3B
2772	Ditch #22	7.0	Habitat Degradation	3B
2773	Ditch #23	5.8	Habitat Degradation	3B
2077	Ditch Cr.	1.8	Fish Bioassessments/Unknown	3B
2770	Ditch to Black R.	9.5	Habitat Degradation	3B
2776	Ditch to Black R.	10.7	Habitat Degradation	3B
2619	Ditch to Ditch #2	1.5	Habitat Degradation	3B
510	Dog Cr.	5.7	Habitat Degradation	3B
182	Dry Br.	5.1	Habitat Degradation	3B
3418	Dry Cr.	9.3	Fish Bioassessments/Unknown	3B
1862	Dry Fk.	23.3	Aquatic Macroinvertebrate Bioassessments/Unknown	3B
1314	Dry Wood Cr.	29.9	Sulfates	2B
288	E. Br. Elkhorn Cr.	4.7	Habitat Degradation	3B
257	E. Br. Squaw Cr.	4.2	Habitat Degradation	3B
3107	E. Ditch #1	22.0	Low Dissolved Oxygen	3B
463	E. Fk. Big Muddy Cr.	2.0	Habitat Degradation	3B
373	E. Fk. Crooked R.	6.4	Habitat Degradation	3B
386	E. Fk. Fishing R.	12.9	Aquatic Macroinvertebrate Bioassessments/Unknown	3B
467	E. Fk. Grand R.	6.5	Habitat Degradation	3B
428	E. Fk. L. Blue R.	3.7	Habitat Degradation	3B
249	E. Fk. L. Tarkio Cr.	17.8	Habitat Degradation	3B
497	E. Fk. Lost Cr.	10.0	Habitat Degradation	3B
932	E. Fk. Postoak Cr.	12.2	Habitat Degradation	3B
398	E. Fk. Shoal Cr.	2.9	Habitat Degradation	3B
402	E. Fk. Sni-a-bar Cr.	9.6	Habitat Degradation	3B
2085	Ebo Cr.	1.6	Fish Bioassessments/Unknown	3B
414	Edmondson Cr.	1.9	Habitat Degradation	3B
130	Elk Fk. Salt R.	7.7	Habitat Degradation	3B
287	Elkhorn Cr.	11.8	Aquatic Macroinvertebrate Bioassessments/Unknown	3B
149	Elm Br.	3.0	Habitat Degradation	3B
331	Elm Grove Br.	4.2	Habitat Degradation	3B
55	Fabius R.	3.5	Habitat Degradation	3B
3370	Fassnight Cr.	2.8	Aquatic Macroinvertebrate Bioassessments/Unknown	3B
1705	Fee Fee Cr. (old)	1.0	Habitat Degradation	3B
1607	Femme Osage Cr.	2.0	Fish Bioassessments/Unknown	3B
7201	Finger Lakes	118.0	Mercury in Fish Tissue	2B
375	Fire Br.	5.4	Habitat Degradation	3B
318	First Cr.	4.7	Bacteria	3B
143	Fish Br.	1.9	Habitat Degradation	3B
394	Fishing R.	8.5	Bacteria	2B
1885	Fishwater Cr.	4.8	Low Dissolved Oxygen	3B
129	Flat Cr.	13.5	Habitat Degradation	3B
3587	Fleck Cr.	4.3	Sulfates	3B
471	Fletchall Cr.	4.0	Habitat Degradation	3B
289	Florida Cr.	8.4	Habitat Degradation	3B
114	Floyd Cr.	5.1	Habitat Degradation	3B
135	Galbreath Cr.	5.8	Habitat Degradation	3B
3373	Galloway Cr.	3.2	Aquatic Macroinvertebrate Bioassessments/Unknown	3B
407	Garrison Fk.	6.8	Habitat Degradation	3B
1496	Gasconade R.	11.2	Fish Bioassessments/Unknown	3B
532	Goose Cr.	4.4	Habitat Degradation	3B
456	Goose Cr.	2.4	Habitat Degradation	3B
72	Grassy Cr.	19.8	Habitat Degradation	3B
7161	Green City Lake	57.0	Mercury in Fish Tissue	3B
233	Greys Lake	5.2	Habitat Degradation	3B
3204	Grove Cr.	2.9	Aquatic Macroinvertebrate and Fish Bioassessments/Unknown	2B
321	Grove Cr.	3.3	Habitat Degradation	3B

WBID	Waterbody Name	Size (mi./ac.)	Potential Pollutant or Condition	Category
2615	Harviell Ditch (#3)	16.2	Habitat Degradation	3B
285	Hayzlett Br.	2.4	Habitat Degradation	3B
2181	Heads Cr.	2.7	Fish Bioassessments/Unknown	3B
1640	Heat String Cr.	1.3	Fish Bioassessments/Unknown	3B
266	Hickory Cr	1.0	Habitat Degradation	3B
308	Hickory Cr.	1.2	Habitat Degradation	3B
442	Hickory Cr.	2.8	Habitat Degradation	3B
335	Hickory Cr.	1.5	Habitat Degradation	3B
490	Hickory Cr.	3.0	Habitat Degradation	3B
186	Hickory Cr.	6.6	Habitat Degradation	3B
229	High Cr.	6.3	Habitat Degradation	3B
228	High Cr. Ditch	3.7	Habitat Degradation	3B
307	Highly Cr.	3.9	Habitat Degradation	3B
350	Holland Br.	3.0	Habitat Degradation	3B
351	Holtzclaw Cr.	2.0	Habitat Degradation	3B
919	Honey Cr.	7.0	Habitat Degradation	3B
509	Honey Cr.	8.3	Habitat Degradation	3B
338	Honey Cr.	6.7	Habitat Degradation	3B
127	Hoover Cr.	7.2	Habitat Degradation	3B
354	Horse Fk.	4.4	Atrazine	3B
306	Huff Cr.	2.0	Habitat Degradation	3B
435	Hurricane Br.	1.8	Habitat Degradation	3B
432	Indian Br.	3.8	Habitat Degradation	3B
211	Indian Camp Cr.	3.3	Habitat Degradation	3B
212	Indian Camp Cr.	3.5	Habitat Degradation	2B
171	Indian Cr.	20.0	Habitat Degradation	3B
477	Indian Cr.	3.2	Habitat Degradation	3B
62	Indian Cr.	3.5	Habitat Degradation	3B
7288	Indian Lake	279.0	Mercury in Fish Tissue	2B
234	Iowa Ditch	2.8	Habitat Degradation	3B
494	Irvins Br.	3.3	Habitat Degradation	3B
485	Island Cr.	8.9	Habitat Degradation	3B
286	Jenkins Cr.	7.2	Habitat Degradation	3B
1719	Joachim Cr.	30.2	Lead in Sediment	2B
184	Johns Br.	1.3	Habitat Degradation	3B
3968	Jones Br.	0.0	VOCs in Sediment	3B
974	Jones Cr.	4.0	Aquatic Macroinvertebrate and Fish Bioassessments/Unknown	3B
275	Jordan Br.	7.2	Habitat Degradation	3B
329	Jordan Cr.	1.4	Habitat Degradation	3B
384	Keeney Cr.	4.9	Habitat Degradation	3B
516	Kettle Cr.	0.8	Habitat Degradation	3B
263	Kimsey Cr.	2.5	Habitat Degradation	3B
264	Kimsey Cr.	6.7	Habitat Degradation	3B
262	Kimsey Cr.	0.8	Habitat Degradation	3B
1334	Kitten Cr.	7.2	Fish Kills	3B
194	L. Bear Cr.	4.0	Habitat Degradation	3B
1656	L. Berger Cr.	1.2	Aquatic Macroinvertebrate and Fish Bioassessments/Unknown	3B
424	L. Blue R.	4.3	Habitat Degradation	3B
118	L. Crooked Cr.	4.7	Habitat Degradation	3B
223	L. Dardenne Cr.	7.4	Aquatic Macroinvertebrate Bioassessments/Unknown	3B
79	L. Fabius R.	36.4	Habitat Degradation	3B
3591	L. Fox Cr.	0.7	Fish Bioassessments/Unknown	3B
39	L. Fox R.	19.8	Aquatic Macroinvertebrate Bioassessments/Unknown	3B
181	L. Lead Cr.	4.0	Habitat Degradation	3B
1619	L. Lost Cr.	1.5	Fish Bioassessments/Unknown	3B
814	L. Moniteau Cr.	5.1	Fish Bioassessments/Unknown	3B
440	L. Muddy Cr.	4.1	Habitat Degradation	3B

WBID	Waterbody Name	Size (mi./ac.)	Potential Pollutant or Condition	Category
526	L. Otter Cr.	3.0	Habitat Degradation	3B
120	L. Otter Cr.	6.2	Habitat Degradation	3B
165	L. Sandy Cr.	6.0	Habitat Degradation	3B
403	L. Sni-a-bar Cr.	6.7	Habitat Degradation	3B
404	L. Sni-a-bar Cr.	7.5	Habitat Degradation	3B
409	L. Tabo Cr.	9.2	Habitat Degradation	3B
250	L. Tarkio Cr.	15.4	Habitat Degradation	3B
251	L. Tarkio Ditch	6.6	Habitat Degradation	3B
328	L. Third Fk. Platte R.	26.0	Habitat Degradation	3B
53	L. Wyaconda R.	7.5	Habitat Degradation	3B
52	L. Wyaconda R.	7.4	Habitat Degradation	3B
7064	Lake Contrary	291.0	Nutrients	3B
359	Lake Cr.	5.7	Habitat Degradation	3B
431	Lake Cr.	3.3	Habitat Degradation	3B
7654	Lake of the Woods Country Club Lake #2	1.0	Mercury in Fish Tissue	3B
7100	Lakewood Lakes	279.0	Mercury in Fish Tissue	2B
507	Larry Cr.	1.2	Habitat Degradation	3B
178	Lead Cr.	1.0	Habitat Degradation	3B
179	Lead Cr.	7.5	Habitat Degradation	3B
515	Lick Fk.	9.8	Habitat Degradation	3B
514	Lick Fk.	5.7	Habitat Degradation	3B
7111	Limpp Community State Lake	27.0	Mercury in Fish Tissue	2B
280	Lincoln Cr.	7.4	Habitat Degradation	3B
452	Little Cr.	11.3	Habitat Degradation	3B
147	Littleby Cr.	16.0	Habitat Degradation	3B
533	Log Cr.	8.8	Habitat Degradation	3B
139	Long Br.	29.0	Habitat Degradation	3B
243	Long Br.	3.0	Habitat Degradation	3B
488	Long Br.	5.7	Habitat Degradation	3B
535	Long Cr.	3.3	Habitat Degradation	3B
1617	Lost Cr.	6.4	Fish Bioassessments/Unknown	3B
466	Lotts Cr.	9.7	Habitat Degradation	3B
425	Lumpkin Cr.	0.5	Habitat Degradation	3B
267	Mace Cr.	5.8	Habitat Degradation	3B
474	Marlowe Cr.	6.7	Habitat Degradation	3B
475	Marlowe Cr.	1.0	Habitat Degradation	3B
511	Marrowbone Cr.	13.9	Habitat Degradation	3B
3661	Marys Cr.	1.0	Metals in Water or Sediment	2B
3277	Mason Springs Valley	1.0	Bacteria	3B
1338	McCarty Cr.	13.2	pH	3B
231	McElroy Cr.	3.0	Habitat Degradation	3B
324	McGuire Br.	5.4	Habitat Degradation	3B
1321	McKill Cr.	2.7	Sulfates and pH	3B
1324	McKill Cr.	2.2	Sulfates and pH	3B
7013	Memphis Reservoir	39.0	Temperature	3B
258	Middle Br. Squaw Cr.	3.0	Habitat Degradation	3B
2744	Middle Fk. Black R.	21.0	Aquatic Macroinvertebrate Bioassessments/Unknown	2B
472	Middle Fk. Grand R.	2.5	Habitat Degradation	3B
496	Middle Fk. Lost Cr.	8.0	Habitat Degradation	3B
245	Middle Tarkio Cr.	10.0	Habitat Degradation	3B
265	Mill Cr.	10.0	Habitat Degradation	3B
301	Mill Cr.	10.8	Habitat Degradation	3B
529	Mill Cr.	1.3	Habitat Degradation	3B
740	Millers Cr.	1.9	Aquatic Macroinvertebrate Bioassessments/Unknown	3B
134	Milligan Cr.	9.0	Habitat Degradation	3B
1544	Mistaken Cr.	1.5	Habitat Degradation	3B
483	Moccasin Cr.	2.6	Habitat Degradation	3B

WBID	Waterbody Name	Size (mi./ac.)	Potential Pollutant or Condition	Category
755	Moniteau Cr.	14.4	Sulfates and pH	3B
1315	Moores Br.	3.0	High Conductivity	3B
302	Moss Br.	2.4	Habitat Degradation	3B
369	Moss Cr.	13.7	Habitat Degradation	3B
426	Mouse Cr.	1.5	Low Dissolved Oxygen	2B
343	Mozingo Cr.	5.1	Habitat Degradation	3B
128	Mud Cr.	17.5	Habitat Degradation	3B
541	Mud Cr.	6.7	Habitat Degradation	3B
538	Mud Cr.	4.5	Habitat Degradation	3B
537	Mud Cr. Ditch	3.5	Habitat Degradation	3B
434	Muddy Cr.	3.7	Habitat Degradation	3B
492	Muddy Cr.	9.7	Habitat Degradation	3B
291	Muddy Cr.	5.2	Habitat Degradation	3B
391	Muddy Fk.	8.4	Aquatic Macroinvertebrate Bioassessments/Unknown	3B
59	N. Fabius R.	1.0	Habitat Degradation	3B
65	N. Fk. M. Fabius R.	28.2	Habitat Degradation	3B
58	N. Fk. N. Fabius R.	9.0	Habitat Degradation	3B
113	N. Fk. Salt R.	17.2	Habitat Degradation	3B
540	N. Mud Cr.	6.2	Habitat Degradation	3B
49	N. Wyaconda R.	9.2	Habitat Degradation	3B
126	Narrows Cr.	2.6	Habitat Degradation	3B
277	Naylor Cr.	1.0	Habitat Degradation	3B
2752	Neals Cr.	3.2	Nickel in Sediment	2B
392	New Hope Cr.	5.5	Habitat Degradation	3B
309	Nichols Cr.	4.6	Habitat Degradation	3B
344	Norvey Cr.	9.3	Habitat Degradation	3B
175	Nulls Cr.	5.8	Habitat Degradation	3B
261	Old Ch. L. Tarkio Cr.	8.3	Habitat Degradation	3B
260	Old Ch. L. Tarkio Cr.	5.3	Habitat Degradation	3B
240	Old Ch. Nishnabotna R.	3.0	Habitat Degradation	3B
238	Old Ch. Nishnabotna R.	13.7	Habitat Degradation	3B
512	Old Chan. Grand R.	15.2	Habitat Degradation	3B
513	Old Chan. Grand R.	3.1	Habitat Degradation	3B
517	Old Chan. Grand R.	2.5	Habitat Degradation	3B
297	Old Chan. Nodaway R.	1.5	Habitat Degradation	3B
311	Old Chan. Nodaway R.	1.0	Habitat Degradation	3B
284	Old Chan. Nodaway R.	10.0	Habitat Degradation	3B
300	Old Chan. Nodaway R.	3.7	Habitat Degradation	3B
305	Old Chan. Nodaway R.	2.8	Habitat Degradation	3B
294	Old Chan. Nodaway R.	1.2	Habitat Degradation	3B
304	Old Chan. Nodaway R.	2.5	Habitat Degradation	3B
299	Old Chan. Nodaway R.	2.5	Habitat Degradation	3B
298	Old Chan. Nodaway R.	1.0	Habitat Degradation	3B
295	Old Chan. Nodaway R.	2.0	Habitat Degradation	3B
325	Old Chan. Platte R.	3.4	Habitat Degradation	3B
326	Old Chan. Platte R.	2.2	Habitat Degradation	3B
348	Old Chan. Platte R.	1.0	Habitat Degradation	3B
341	Old Chan. Platte R.	5.0	Habitat Degradation	3B
332	Old Chan. Platte R.	4.0	Habitat Degradation	3B
368	Old Chan. Wakenda Cr.	3.0	Habitat Degradation	3B
1472	Osage Fk.	69.0	Bacteria	2B
2962	Otter Cr.	6.0	Low Dissolved Oxygen	3B
525	Otter Cr.	2.5	Habitat Degradation	3B
357	Palmer Cr.	12.2	Habitat Degradation	3B
358	Palmer Cr.	2.8	Habitat Degradation	3B
460	Panther Cr.	4.8	Habitat Degradation	3B
521	Panther Cr.	5.0	Habitat Degradation	3B

WBID	Waterbody Name	Size (mi./ac.)	Potential Pollutant or Condition	Category
176	Paris Br.	3.0	Habitat Degradation	3B
2425	Peckout Hollow	1.8	Aquatic Macroinvertebrate and Fish Bioassessments/Unknown	3B
470	Peddler Cr.	3.0	Habitat Degradation	3B
469	Peddler Cr.	1.5	Habitat Degradation	3B
283	Pedlar Cr.	5.4	Habitat Degradation	3B
1616	Peers Slough	3.0	Aquatic Macroinvertebrate and Fish Bioassessments/Unknown	3B
349	Pigeon Cr.	7.2	Habitat Degradation	3B
2813	Pike Cr. Ditch	4.0	Habitat Degradation	3B
439	Pilot Grove Cr.	5.4	Habitat Degradation	3B
2692	Pine Cr.	1.0	Fish Bioassessments/Unknown	3B
1728	Plattin Cr.	19.9	Ammonia	2B
2058	Pleasant Valley Cr.	1.7	High Conductivity	3B
445	Polecat Cr.	11.1	Habitat Degradation	3B
2192	Pomme Cr.	1.8	Habitat Degradation	3B
2127	Pond Cr.	1.3	Zinc in Sediment and Sediment Deposition	2B
195	Poor Br.	3.0	Habitat Degradation	3B
7409	Port Hudson Lake	48.0	Mercury in Fish Tissue	3B
313	Prairie Cr.	3.7	Habitat Degradation	3B
520	Rattlesnake Cr.	3.0	Habitat Degradation	3B
2037	Red Oak Cr.	5.2	Low Dissolved Oxygen	2B
136	Reese Fk.	7.0	Habitat Degradation	3B
168	Reid Cr.	2.0	Habitat Degradation	3B
347	Riggin Br.	1.9	Habitat Degradation	3B
3827	River des Peres	3.7	Chloride and Bacteria	3B
355	Roberts Br.	2.0	Atrazine	3B
237	Rock Cr.	19.0	Habitat Degradation	3B
236	Rock Cr.	2.2	Habitat Degradation	3B
78	Rock Cr.	4.8	Habitat Degradation	3B
378	Rocky Fk.	4.0	Habitat Degradation	3B
382	Rollins Cr.	7.0	Habitat Degradation	3B
278	Rush Cr.	4.5	Bacteria	3B
506	S. Big Cr.	5.6	Habitat Degradation	3B
108	S. Brush Cr.	2.0	Habitat Degradation	3B
921	S. Fk. Blackwater R.	5.7	Habitat Degradation	3B
293	S. Fk. Clear Cr.	6.0	Habitat Degradation	3B
67	S. Fk. M. Fabius R.	14.8	Habitat Degradation	3B
68	S. Fk. M. Fabius R.	13.0	Habitat Degradation	3B
60	S. Fk. N. Fabius R.	11.5	Habitat Degradation	3B
76	S. Fk. S. Fabius R.	7.9	Habitat Degradation	3B
77	S. Fk. S. Fabius R.	18.3	Habitat Degradation	3B
542	S. Mud Cr.	3.8	Habitat Degradation	3B
51	S. Wyaconda R.	17.5	Habitat Degradation	3B
2189	Saline Cr.	1.8	Low Dissolved Oxygen	3B
2190	Saline Cr.	2.3	Low Dissolved Oxygen	3B
413	Salt Br.	5.7	Habitat Degradation	3B
453	Sampson Cr.	13.5	Habitat Degradation	3B
455	Sampson Cr.	5.6	Habitat Degradation	3B
290	Sand Cr.	4.9	Habitat Degradation	3B
206	Sand Run	2.0	Habitat Degradation	3B
183	Sandy Cr.	6.0	Habitat Degradation	3B
952	Scott Br.	0.5	Ammonia and Low Dissolved Oxygen	3B
317	Second Cr.	11.5	Habitat Degradation	3B
7253	See Tal Lake	11.0	Mercury in Fish Tissue	3B
385	Shackelford Br.	5.9	Habitat Degradation	3B
172	Shady Cr.	9.4	Habitat Degradation	3B
450	Shain Cr.	13.0	Habitat Degradation	3B
2865	Shays Cr.	1.7	Arsenic and Lead in Sediment	3B

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530	Sheep Cr.	1.0	Habitat Degradation	3B
518	Shoal Cr.	54.6	Habitat Degradation	3B
3229	Shoal Cr.	0.5	Bacteria	3B
396	Shoal Cr.	10.3	Habitat Degradation	3B
397	Shoal Cr.	10.6	Low Dissolved Oxygen	3B
1934	Shoal Cr.	7.7	Fish Bioassessments/Unknown	3B
519	Shoal Cr. Ditch	9.8	Habitat Degradation	3B
3244	Silver Cr.	1.9	Lead and Zinc in Sediment	2B
173	Sitton Br.	0.8	Habitat Degradation	3B
174	Sitton Br.	2.8	Habitat Degradation	3B
739	Smith Cr.	1.5	Low pH and High Conductivity	3B
353	Smith Fk.	3.0	Habitat Degradation	3B
401	Sni-a-bar Cr.	4.3	Habitat Degradation	3B
2775	Snyder Ditch	6.5	Habitat Degradation	3B
3	South R.	16.3	Aquatic Macroinvertebrate Bioassessments/Unknown	3B
5004	Spring Branch	6.7	Habitat Degradation	2B
7187	Spring Fork Lake	178.0	Nutrients	2B
3159	Spring R.	0.5	Heavy Metals in Sediment	3B
3167	Spring R.	1.0	suspected of high bacteria	3B
252	Squaw Cr.	21.0	Habitat Degradation	3B
1486	Steins Cr.	16.6	Fish Bioassessments/Unknown	3B
2355	Stewart Cr.	3.0	Fish Bioassessments/Unknown	3B
2810	Stillcamp Ditch	12.3	Habitat Degradation	3B
489	Stillhouse Br.	2.0	Habitat Degradation	3B
1030	Sugar Br.	3.0	Ammonia and Low Dissolved Oxygen	3B
1029	Sugar Br.	2.3	Low Dissolved Oxygen	3B
156	Sugar Cr.	11.0	Aquatic Macroinvertebrate Bioassessments/Unknown	3B
270	Sugar Cr.	3.0	Habitat Degradation	3B
271	Sugar Cr.	6.5	Habitat Degradation	3B
169	Sulphur Cr.	9.3	Habitat Degradation	3B
2866	Sweetwater Br.	1.0	Heavy Metals in Sediment	3B
2867	Sweetwater Br.	1.7	Heavy Metals in Sediment	3B
406	Tabo Cr.	8.4	Habitat Degradation	3B
405	Tabo Cr.	11.4	Habitat Degradation	3B
2509	Tabor Cr.	5.6	Aquatic Macroinvertebrate and Fish Bioassessments/Unknown	3B
458	Thompson Br.	1.0	Habitat Degradation	3B
437	Thompson Cr.	1.6	Habitat Degradation	3B
3763	Tiff Cr.	2.1	Fish Bioassessments/Unknown	3B
64	Tobin Cr.	8.0	Habitat Degradation	3B
239	Tr. to O. Ch. Nishnabotna R.	0.9	Habitat Degradation	3B
241	Tr. to O. Ch. Nishnabotna R.	2.0	Habitat Degradation	3B
365	Trib to Crabapple Cr.	1.3	Habitat Degradation	3B
473	Trib. M. Fk. Grand R.	1.4	Habitat Degradation	3B
125	Trib. M. Fk. Salt R.	1.0	Habitat Degradation	3B
3967	Trib. to Bee Cr.	0.5	Heavy Metals in Sediment and/or Water	3B
274	Trib. to Bee Cr.	1.8	Habitat Degradation	3B
2923	Trib. to Big Cr.	1.0	Heavy Metals in Sediment	3B
2674	Trib. to Big Cr.	3.0	Fish Bioassessments/Unknown	3B
323	Trib. to Castile Cr.	1.2	Habitat Degradation	3B
393	Trib. to Clear Cr.	2.2	Habitat Degradation	3B
254	Trib. to Davis Cr.	3.0	Habitat Degradation	3B
374	Trib. to E. Fk. Crooked R.	4.8	Habitat Degradation	3B
429	Trib. to E. Fk. L. Blue R.	1.9	Habitat Degradation	3B
415	Trib. to Edmondson Cr.	3.1	Habitat Degradation	3B
504	Trib. to Grindstone Cr.	1.0	Habitat Degradation	3B
232	Trib. to High Cr.	2.0	Habitat Degradation	3B
3962	Trib. to L. Blue R.	5.9	Habitat Degradation	2B

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166	Trib. to L. Sandy Cr.	2.1	Habitat Degradation	3B
303	Trib. to Mill Cr.	1.8	Habitat Degradation	3B
2115	Trib. to Mineral Fk.	2.0	Lead in Sediment	2B
411	Trib. to Missouri R.	5.3	Habitat Degradation	3B
370	Trib. to Moss Cr.	0.5	Habitat Degradation	3B
544	Trib. to Mud Cr.	2.0	Habitat Degradation	3B
546	Trib. to Mud Cr.	0.8	Habitat Degradation	3B
545	Trib. to Mud Cr.	1.0	Habitat Degradation	3B
3261	Trib. to N. Indian Cr.	1.3	Aquatic Macroinvertebrate Bioassessments/Unknown	3B
310	Trib. to Nichols Cr.	1.3	Habitat Degradation	3B
281	Trib. to Nodaway R.	1.0	Habitat Degradation	3B
522	Trib. to Panther Cr.	2.4	Habitat Degradation	3B
314	Trib. to Prairie Cr.	1.0	Habitat Degradation	3B
61	Trib. to S. Fk. N. Fabius R.	4.1	Habitat Degradation	3B
146	Trib. to S. Fk. Salt R.	0.5	Habitat Degradation	3B
2868	Trib. to Sweetwater Br.	1.0	Lead in Sediment	3B
524	Trib. to Turkey Cr.	1.0	Habitat Degradation	3B
500	Trib. to W. Fk. Lost Cr.	2.8	Habitat Degradation	3B
501	Trib. to W. Fk. Lost Cr.	2.6	Habitat Degradation	3B
481	Trib. to Wildcat Cr.	2.0	Habitat Degradation	3B
484	Trib. to Wildcat Cr.	2.0	Habitat Degradation	3B
73	Troublesome Cr.	4.8	Aquatic Macroinvertebrate Bioassessments/Unknown	3B
534	Tub Cr.	1.0	Habitat Degradation	3B
361	Turkey Cr.	4.7	Habitat Degradation	3B
138	Turkey Cr.	3.3	Habitat Degradation	3B
362	Turkey Cr.	3.5	Habitat Degradation	3B
523	Turkey Cr.	2.5	Habitat Degradation	3B
2985	Turkey Cr.	3.1	Ammonia and Low Dissolved Oxygen	3B
199	Turkey Cr.	1.5	Habitat Degradation	3B
486	Turkey Cr.	1.8	Habitat Degradation	3B
412	Van Meter Ditch	4.5	Habitat Degradation	3B
449	W. Fk. Big Cr.	18.0	Habitat Degradation	3B
379	W. Fk. Crooked R.	6.6	Habitat Degradation	3B
380	W. Fk. Crooked R.	9.8	Habitat Degradation	3B
177	W. Fk. Cuivre R.	42.4	Habitat Degradation	3B
185	W. Fk. Cuivre R.	23.9	Habitat Degradation	3B
499	W. Fk. Lost Cr.	11.7	Habitat Degradation	3B
929	W. Fk. Post Oak Cr.	12.8	Habitat Degradation	3B
367	W. Fk. Wakenda Cr.	7.8	Habitat Degradation	3B
366	W. Fk. Wakenda Cr.	3.3	Habitat Degradation	3B
230	W. High Cr.	2.8	Habitat Degradation	3B
246	W. Tarkio Cr.	9.6	Habitat Degradation	3B
244	W. Tarkio Cr.	1.2	Habitat Degradation	3B
364	Wakenda Cr.	10.6	Habitat Degradation	3B
360	Wakenda Cr.	29.2	Habitat Degradation	3B
2136	Wallen Cr.	1.4	Aquatic Macroinvertebrate Bioassessments/Unknown	3B
1339	Walnut Cr.	2.3	Low Dissolved Oxygen	3B
487	Walnut Fk.	4.3	Habitat Degradation	3B
505	Wamsley Cr.	1.7	Habitat Degradation	3B
2374	Ward Br.	3.3	Aquatic Macroinvertebrate Bioassessments/Unknown, pH,Bacteria	3B
7072	Waukomis Lake	76.0	Mercury and Chlordane in Fish Tissue	2B
459	Weldon Br.	4.4	Habitat Degradation	3B
503	Wheeler Cr.	2.4	Habitat Degradation	3B
200	Whitcomb Br.	2.5	Habitat Degradation	3B
346	White Cloud Cr.	12.8	Habitat Degradation	3B
454	White Oak Cr.	9.0	Habitat Degradation	3B
190	White Oak Cr.	2.6	Habitat Degradation	3B

WBID	Waterbody Name	Size (mi./ac.)	Potential Pollutant or Condition	Category
259	Wildcat Cr.	4.0	Habitat Degradation	3B
482	Wildcat Cr.	7.4	Habitat Degradation	3B
480	Wildcat Cr.	6.2	Habitat Degradation	3B
387	Williams Cr.	9.1	Habitat Degradation	3B
498	Willow Cr.	1.0	Habitat Degradation	3B
543	Willow Cr.	1.5	Habitat Degradation	3B
381	Willow Cr.	6.5	Habitat Degradation	3B
122	Winn Br.	5.0	Habitat Degradation	3B
191	Wolf Cr.	4.5	Habitat Degradation	3B
47	Wyaconda R.	42.2	Bacteria	2B
210	Yeater Br.	2.6	Habitat Degradation	3B
448	Zadie Cr.	5.3	Habitat Degradation	3B
479	Zounds Cr.	3.0	Habitat Degradation	3B

MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

2016 303(d) List
RESPONSES TO PUBLIC COMMENTS

Public Notice
October 1, 2015 – January 31, 2016

Missouri Department of Natural Resources
Water Protection Program
PO Box 176
Jefferson City, MO 65102-0176
800-361-4827 / 573-751-1300

INTRODUCTION

Pursuant to 40 CFR 130.7, States, Territories and authorized Tribes must submit biennially to the U.S. Environmental Protection Agency (EPA) a list of water-quality limited (impaired) segments, pollutants causing impairment, and the priority ranking of waters targeted for Total Maximum Daily Load (TMDL) development. The Missouri Department of Natural Resources (department) placed the draft 2016 303(d) List of impaired waters on public notice from Oct. 1, 2015 to Jan. 31, 2016. All original comments received during this public notice period are available online on the department's website at http://dnr.mo.gov/env/wpp/waterquality/303d/303d.htm. Comments were received from the following groups or individuals:

Newman, Comley and Ruth P.C. Law Firm
City of Independence
Boone County
City of Springfield
EPA, Region 7
Missouri Department of Conservation

This document summarizes and paraphrases the comments received, provides the department's responses to those comments, and notes any changes made to the final draft 2016 303(d) List of Impaired Waters or supporting documentation. A priority ranking of impaired waters for TMDL development will be produced and placed on public notice following approval of the 2016 303(d) List by the Missouri Clean Water Commission.

Newman, Comley and Ruth comments

Cave Springs Branch (WBID 3245U-01) – Category 4A water body

No data was offered to support the 1998 impairment listing for Cave Springs Branch other than a suggestion the watercourse had unsightly bottom deposits. In 2010, the Clean Water Commission approved the removal of Cave Springs Branch from the Missouri impaired waters list, but the EPA reinstated the listing without any additional data to suggest unsightly bottom deposits persisted. A discussion regarding wastewater treatment facility upgrades completed by Simmons Foods, in addition to chemical and biological report summaries were provided as evidence the watercourse is no longer impaired for unsightly bottom deposits. It is recommended that Cave Springs Branch be removed from the 303(d) List and the TMDL be rescinded.

Department Response

Cave Springs Branch has not been included on the draft 2016 303(d) List of impaired waters and therefore cannot be "removed" from the list. The department recognizes and appreciates the facility upgrades completed by Simmons Foods to improve their

wastewater treatment processes. In 2010, CSB was moved from Category 5 (i.e., the 303(d) List) of Missouri's Integrated Report to Category 4A, due to EPA approval of the Cave Springs Branch TMDL to address total nitrogen and total phosphorus attributed to cause the excess production of benthic (bottom growing) algae (http://dnr.mo.gov/env/wpp/tmdl/docs/3245u-01-cave-springs-br-tmdl.pdf). The TMDL recognizes that improvements to the wastewater treatment facilities at Simmons Foods, Inc., have improved water quality in CSB and, as the comment references, the department has monitored these improvements. However, land application of poultry litter and fertilizer can and do continue to cause or contribute to nutrient loading in the Cave Springs Branch watershed. In this respect, the TMDL should not be considered invalid and reductions in nutrient loading, particularly through reductions from nonpoint sources, are still relevant and implementable to meet TMDL targets.

Furthermore, the purpose of a TMDL is to determine the pollutant loading a water body can assimilate without exceeding Missouri's Water Quality Standards. The EPA guidance document "Considerations for Revising and Withdrawing TMDLs," recommends that "existing TMDLs not be withdrawn simply because the load and wasteload allocations have been implemented successfully and the water is now attaining water quality standards. EPA recommends that such "successful" TMDLs remain in place to ensure that water quality standards continue to be maintained in the future, and that their water quality analyses and allocation targets continue to inform permit writers' and stakeholders' efforts to maintain those water quality standards." As discussed previously with Simmons Foods and its consultants, a successful water quality attainment demonstration would place Cave Springs Branch in an attaining category within Missouri's Integrated Report and future enhancement to the facility with regard to nutrients may not be necessary. Should Simmons Foods wish to pursue this option further, please contact the department's Watershed Protection Section, Monitoring and Assessment Unit. No changes were made to the proposed 2016 303(d) List as a result of this comment.

Middle Fork Black River (WBID 2744)

This water body was originally listed in 2012, but was removed from the 303(d) List during the 2014 listing cycle. Documentation was provided that supported the 2014 delisting decision.

Department Response

The department appreciates Newman, Comley and Ruth bringing this oversight to the department's attention. This water body was inadvertently added back to the impaired waters list during the current listing cycle. The waterbody will be reinstated into

Category 2B within Missouri's Integrated Report for the aquatic life protection use. A comment was added to the Middle Fork Black River assessment worksheet and the department's assessment database to note this change.

West Fork Black River (WBID 2755) – Category 4A water body

The Doe Run Company requests the department remove the West Fork Black River nutrient impairment from the 303(d) List. The West Fork Black River was placed on the 1998 impaired list for nutrients 0.2 miles downstream of the West Fork Mine. A department study completed in 2002 and 2003 found low levels of chlorophyll in the stream, and the West Fork Doe Run discharge cannot be determined conclusively as contributing a significant nutrient load resulting in increased periphyton growth. To date, the department nor EPA has produced any studies to document the general criteria or recreational uses have been impaired by nutrients in the West Fork Black River, nor evidence that benthic algae is impairing recreational uses.

Department Response

West Fork Black River has not been included on the draft 2016 303(d) List of impaired waters for nutrient impairment and therefore cannot be "removed" from the list. During the 2008 303(d) listing cycle, the department recommended removing the West Fork Black River from the impaired waters list for nutrients. The recommendation for delisting was not approved by EPA. In 2010, WFBR was moved from Category 5 (i.e., the 303(d) List) of Missouri's Integrated Report to C*ategory 4A*, due to EPA establishing a TMDL for nutrients to address the impairment. The TMDL was developed by EPA, Region 7 as a result of a 2001 consent decree, *American Canoe Association, et al. v. EPA, No.98-1195-CV-W in consolidation with No. 98-4282-CV-W, February 27, 2001*. The TMDL is based upon water quality measurements for total nitrogen, total phosphorus, chlorophyll, and flow data collected from 2001 to 2009. The nutrient data is attached as Appendix A of the West Fork Black River TMDL http://dnr.mo.gov/env/wpp/tmdl/docs/2755-w-fk-black-r-tmdl.pdf.

The department agrees that available studies and information suggest that West Fork Black River is on a path toward attaining applicable water quality standards. As discussed previously with the Doe Run Company and its consultants, a successful water quality attainment demonstration would place West Fork Black River in an attaining category within Missouri's Integrated Report and future enhancement to the facility with regard to nutrients may not be necessary. Should the Doe Run Company wish to pursue this option further, please contact the department's Watershed Protection Section, Monitoring and Assessment Unit. No changes were made to the proposed 2016 303(d) List as a result of this comment.

The City of Independence comments

Little Blue River (WBID 0422)

Additional U.S. Geological Survey (USGS) bacterial data is available for the Little Blue River at 39th Street (site number 06893910) from 2006 to 2009. The USGS has been sampling the Little Blue River and other waters under a cooperative agreement with the City of Independence to satisfy requirements of the City's Municipal Separate Storm Sewer System (MS4) permit. This site is located upstream from most of the City of Independence's MS4.

Department Response

The department was unaware this data existed and appreciates the information. The department will include the site information and data in future listing cycles. No changes were made to the proposed 2016 303(d) List as a result of this comment.

The City of Independence also provided a comment that relates to the TMDL development, rather than the listing process itself, due to concerns about future TMDL requirements that may be established for the Independence MS4. Based upon a USGS report, increased bacteria densities correlated with increased suspended sediment during storms at all sites. Therefore, when the department develops the Little Blue River TMDL, please keep the following in mind:

- *If storm water influenced samples are included, the Little Blue River exceeds the bacteria standard for whole body contact before the river enters the City of Independence.*
- *TMDL development efforts may require a broader scope beyond the MS4 to address non-human sources of bacteria.*

Because of the predominance of non-human sources and re-suspension issues, the department should make TMDL development for this section of the Little Blue River a low priority.

Department Response

The department appreciates the comment and will share it with the Water Protection Program, Watershed Protection Section, TMDL/Modeling Unit. No changes were made to the proposed 2016 303(d) List as a result of this comment.

Spring Branch (WBID 5004)

The City of Independence provided a comment regarding the USGS gage located on the bridge at Holke Road. Dissolved oxygen data was collected from this site for a number of years from 2005-2007, but the data was rated as "poor" by the USGS and not representative of the stream due to rip rap catching debris and sediment. The monitoring site was subsequently relocated downstream. The USGS also provided follow-up information about this site and agreed the data was not representative of instream conditions.

Department Response

The department appreciates the information. This monitoring site was removed from the assessment worksheet and the data reassessed. The revised assessment indicates that Spring Branch is unimpaired by low dissolved oxygen, and therefore will be removed from the draft 2016 303(d) List.

Boone County comments

Little Cedar Creek (WBID 0744)

The Little Cedar Creek at Zaring Road is located far upstream from the section of stream that is proposed for listing on the 2016 303(d) List. This site appears to be located below a box culvert where the stream only flows following precipitation events. During baseflow conditions, a pool of water is retained below the box culvert, and the county believes this is an inappropriate site for sampling dissolved oxygen. In addition, during the informational meeting it was discussed that USGS stream flow data was not included. Therefore, there are no indications that flow patterns in the Little Cedar Creek were different during 1999 to 2002.

Department Response

Based upon the comment, and information provided during the Nov. 3, 2015 public availability meeting, department staff confirmed the site location provided on the draft 2016 303(d) List was incorrect. Further investigation revealed the dissolved oxygen data was not collected from Little Cedar Creek, thereby making the assessment invalid. This water body will be removed from the draft 2016 303(d) List due to these assessment errors.

The City of Springfield comments

Ward Branch (WBID 2374)

The City provided a comment and supporting information regarding the impairment listing on Ward Branch for pH. The City believes the listing should be removed for multiple reasons. The pH data were collected following a first flush event, and were not measured according to EPA procedures. In addition, other data collected as part of a Section 319 Nonpoint Source grant project did not indicate a pH impairment in Ward Branch.

Department Response

The department appreciates the clarification regarding how pH data was collected and analyzed from Ward Branch. Since the data are not considered representative of annual ambient conditions, and were not collected or analyzed following EPA protocols, the data will not be used for assessing Ward Branch. Therefore, this water body will be removed from the draft 2016 303(d) List and a comment will be added to the Ward Branch assessment worksheet for future reference.

Regarding the Ward Branch assessment workbook, the City recommended that the department should either completely remove the tab labeled "Inverts" or clearly note that until such time appropriate reference stream data are collected, existing biological data cannot be used for impairment decisions, and references to macroinvertebrate score criteria and explicit statements of impairment should also be removed.

Department Response

The department agrees with the City in this instance, but would like to note that other chemical or biological data are often provided as supplemental information to support a listing or delisting determination. Since the pH impairment listing will be removed from the draft 2016 303(d) List, the Ward Branch assessment workbook will be removed from the department's webpage as it is no longer applicable.

Wilsons Creek (WBID 2375)

The City of Springfield provided a comment in favor of delisting Wilsons Creek for polycyclic aromatic hydrocarbons (PAHs) based upon additional data resulting in a geometric mean less than 150 percent of the probable effect concentration (PEC) threshold. Additionally, toxicity data recently made available on EPA's Storage and Retrieval (STORET) website provides strong evidence that there are no toxicity issues in

Wilsons Creek. In addition, the "Sediment PAHs" assessment worksheet states that PAHs exceeded 150 percent of the PEC thresholds upstream of the Southwest Treatment Plant. However, this assertion is not supported by the data table, which shows the PAH geometric mean is below 150 percent upstream of the Southwest Treatment Plant. The City requests the department correct this issue in the listing worksheet.

Department Response

Department staff reviewed the information and agrees the data is promising with respect to water quality status of the creek. However, the department would like some additional information and further evaluation of this data before supporting a de-listing decision. The department agrees that an assessment worksheet for sediment should not have been included with the impairment listing for E. coli. However, it should be noted that the EPA also provided a comment regarding Wilsons Creek which required a correction to the sediment assessment worksheet. A department response addressing the correction can be found under EPA comments for this water body.

In addition, the City provided a comment that the department should either completely remove the tab labeled "Inverts" or clearly note that until such time appropriate reference stream data are collected, existing biological data cannot be used for impairment decisions. References to macroinvertebrate score criteria and explicit statements of impairment should be removed. The City also finds the use of fish Index of Biotic Integrity (IBI) metrics questionable and suggests renaming the tab labeled "Community-4A", which incorrectly suggests that Wilsons Creek is currently on the 305(b) category 4A and has a completed TMDL.

Department Response

As previously noted in the response for Ward Branch, other chemical or biological data are often included to support a listing or delisting decision. The department agrees, however, that the assessment worksheet for "Inverts" should not have been included with the impairment listing for Escherichia coli, or E. coli. Biological data does not directly support a bacteriological impairment, therefore, the assessment worksheet should have been removed under these circumstances. However, as previously stated EPA also provided a comment on Wilsons Creek that caused the community tab to be retained. Therefore, in response to this comment, the department has added a note to the assessment worksheet stating the TDML was vacated and the assessment worksheet tab was also relabeled.

Jordan Creek (WBID 3374)

The City of Springfield finds that the department's rationale for listing Jordan Creek as impaired does not meet the weight of evidence requirements outlined in the 2016 Listing Methodology Document (LMD). The draft list identifies Jordan Creek as impaired based upon sediment samples that exceeded the 150 percent of the PEC threshold for PAH compounds. However, sediment data alone is not sufficient for listing Jordan Creek as impaired.

Department Response

Department staff reviewed the information and agrees the data is promising with respect to water quality status of the creek. However, the department would like some additional information and further evaluation of this data before supporting a de-listing decision.

The 2013 sediment data was not previously assessed by the department due to the timing of when the data became available during the 2014 listing cycle. The 2013 sediment data was collected and assessed by EPA. Benthic sediment data was collected to determine if pollutants within the sediments were contributing to the aquatic life impairment. The EPA placed Jordan Creek on the 2014 303(d) List for PAHs in sediment following the 2014 LMD approved by the Clean Water Commission May 2, 2012 (2014 EPA approval memo: http://dnr.mo.gov/env/wpp/waterquality/docs/2014-epa-approval-memo.pdf). In reviewing the available data during the 2016 listing cycle, the category 5 (303(d) List) decision was retained by the department. As stated, the geometric mean of sediment data was assessed following the 2014 LMD at 150 percent of the PEC thresholds for PAH compounds. The 150 percent PEC verses the 100 percent PEC threshold provides a conservative assessment of sediment toxicity and its potential for toxicity to aquatic life. In reviewing the sediment data collected in 2013, the geometric mean for the PAH compounds exceeded the 150 percent thresholds anywhere between 50 percent and 106 percent, indicating an increased potential for sediment toxicity.

The City of Springfield also commented that the department includes aquatic biological data as part of its rationale. The City states the data should not be used until such time as appropriate reference stream data is available. The City believes it is inappropriate to make listing decisions based on such data. Either completely remove the tab labeled "Community-4A" or clearly note that until such time appropriate reference stream data is collected, existing biological data cannot be used for impairment decisions. In addition, fish IBI scores only apply to streams of 3rd to 5th order in size in the Ozark ecoregion. The Community-4A tab incorrectly suggests that Jordan Creek is currently in 305(b) category 4A and has a completed TMDL.

Department Response

The department would like to reiterate that other chemical or biological data are often provided as supplemental information to support a listing or delisting determination.

In February 2013, the US District Courts vacated the Wilsons Creek and Jordan Creek TMDLs (http://dnr.mo.gov/env/wpp/tmdl/2375-wilsons-3374-jordan-cks-record.htm). These water bodies should have been reinstated into a category 5 listing and retained on the 303(d) List. However, during the 2014 listing cycle EPA approved the department's request for Jordan Creek to be moved from a Category 5 listing to Category 3B (available data suggested noncompliance but there is insufficient data to conduct a full assessment in accordance with the LMD - 2014 EPA approval memo: http://dnr.mo.gov/env/wpp/waterquality/docs/2014-epa-approval-memo.pdf). In response to this comment, the department has added a note to the assessment worksheet stating the TMDL was vacated and the worksheet tab was re-labeled.

Regarding the Fish IBI scores provided on the Jordan Creek assessment worksheet, it appears this information has been provided on the assessment worksheet since 2010. This information was based upon data presented in a Springfield City Utilities study report. The results of this study were used to support the original placement of Jordan Creek in a Category 5 listing due to a decline in biodiversity in the aquatic community.

Per the City of Springfield, recent toxicity data is available from the EPA Storage and Retrieval (STORET) website and provides strong evidence there are no toxicity issues in Jordan Creek. The City also provided a summary of toxicity data collected from Jordan Creek and a biocriteria reference site on May 19, 2015 and June 23, 2015.

Department Response

The department was unaware that 2015 data was uploaded to the EPA STORET website. For the 2016 assessment cycle, the EPA STORET website was queried and all available data was downloaded in October, 2014. Any data uploaded to the EPA STORET website after this time was not available for the 2016 assessment. No changes were made to the proposed 2016 303(d) List as a result of these comments.

North Branch Wilsons Creek (WBID 3811)

The City of Springfield provided a comment stating it finds the department's supporting rationale for listing North Branch Wilsons Creek as impaired does not meet the weight of evidence requirements outlined in the 2016 LMD. North Branch Wilsons Creek is

impaired for zinc based on sediment data that exceeds 150 percent of the PEC. Missouri's LMD states the department will use a weight of evidence analysis for evaluating all narrative criteria and in the case of toxic chemicals occurring in benthic sediment rather than water, the numeric thresholds used to determine the need for further evaluation will be the PEC. Accordingly, exceedences of PEC values should only be used to place water bodies in category 3B of the LMD, or as part of the weight of evidence analysis. Without additional data or biological or toxicity data, there is insufficient evidence that North Branch Wilsons Creek is impaired. The city requests North Branch Wilsons Creek be delisted.

Department Response

The 2013 sediment data was not previously assessed by the department due to the timing of when the data became available during the 2014 listing cycle. The 2013 sediment data were collected and assessed by EPA. The EPA placed North Branch Wilsons Creek on the 2014 303(d) List for elevated zinc in sediment following the 2014 LMD approved by the Clean Water Commission on May 2, 2012. New information was not available at the time of the 2016 assessment cycle to justify a change to the listing determination. This water body will be prioritized for additional monitoring. No changes were made to the proposed 2016 303(d) List as a result of this comment.

Pearson Creek (WBID 2373)

The City of Springfield does not support the department's listing of Pearson Creek for an aquatic life impairment stating the department compared Pearson Creek biological data to inappropriate reference stream data. In addition, the worksheet tab labeled "Invert-5" should be either removed or all reference to impairment decision be deleted along with references to macroinvertebrate score criteria. It should be noted until such time that appropriate reference stream data is collected, existing biological data cannot be used for impairment decisions.

Department Response

Pearson Creek was originally placed in Category 5 during the 2002 assessment cycle due to reduced aquatic biodiversity caused by unknown toxicity. In 2011 a TMDL was developed by EPA, but was later vacated (see below response for additional information). During the 2014 listing cycle, the department requested the water body be removed from Category 5 and placed into Category 3B (available data suggested noncompliance but there is insufficient data to conduct a full assessment in accordance with the LMD) based on a public comment received from the City of Springfield that the aquatic macroinvertebrate community was inappropriately assessed against biological reference

streams provided within Table I of Missouri's Water Quality Standards. EPA rejected the delisting of Pearson Creek because it was originally listed as impaired for a documented decline in biotic diversity due to unknown pollutants. This cause of impairment was not dependent upon an assessment of the state's Macroinvertebrate Stream Condition Index (MSCI) score procedure (http://dnr.mo.gov/env/wpp/waterquality/docs/2014-epa-approval-memo.pdf). Additional studies by the department have been scheduled to determine if the biotic diversity in Pearson Creek has improved since its original listing.

The City of Springfield also had questions and concerns regarding a biological study completed by URS Corporation and the methodology followed.

Department Response

The Pearson Creek biological study was completed by URS Corporation in 2009 under contract with EPA. A copy of the report was obtained from EPA and provided to the City. According to the report, titled "Sampling for Consent Decree Waters In Missouri: Pearson Creek Springfield, MO Task Order No. 2008-54", the aquatic macroinvertebrates were collected following the departments sampling and enumeration protocols for field work and analysis [footnote: MoDNR Semi-Quantitative Macroinvertebrate Stream Bioassessment Project Procedure and MoDNR Stream Habitat Assessment Project Procedure]. The macroinvertebrate samples were then sorted, and identification and calculation of performance metrics were completed, by the Ozarks Environmental and Water Resources Institute (OEWRI) in accordance with department protocols.

The City of Springfield noted the assessment worksheet only presents one habitat score and it is unclear what the value in the worksheet represents.

Department Response

Following the department's protocol, one habitat assessment is completed once per site per season (fall or spring). The department's habitat scores have been added to the assessment worksheet. The URS report provided habit scores, but the department was uncertain how these scores compared to reference stream conditions. A specific reference stream was not discussed in the URS report, and therefore, the URS data was removed from the Pearson Creek assessment worksheet. This revision did not change the Category 5 listing determination.

The City of Springfield commented that the assessment worksheet indicates that 95 percent of the reference streams score 16 or higher. Does this mean that on the

assessment date 8/7/2015, 95 percent of the streams scored 16 or above, or is the value adjusted over time? It would seem likely that the percentage would change over time.

Department Response

The department appreciates the question and opportunity for clarification. Additional information and details have been added to the assessment worksheet to explain the reference stream percentage scores per sampling season.

The City of Springfield noted that four of the samples are more than seven (7) years old from the original listing date (2014). The department is supposed to provide a written justification for using the data on the assessment worksheets.

Department Response

The 2004, 2005, 2009, and 2014 macroinvertebrate studies have not indicated changes in the watershed that would cause the "older" data to no longer be considered representative of current conditions. Without additional information indicating the data is no longer representative, it is reasonable to assume the older data is still representative. According to EPA guidance, the data should not automatically be treated as unrepresentative of relevant segment conditions solely on the basis of age without supporting information indicating that the data are not a good indicator of current conditions. An explanation for utilizing the "older" data has been added to the Pearson Creek assessment worksheet.

Per the City of Springfield recent toxicity data available for the EPA STORET website provides strong evidence that there are no toxicity issues in Pearson Creek. The City provided a summary of the toxicity data from Pearson Creek and a biocriteria reference site for samples collected on May 19, 2015 and June 23, 2015.

Department Response

The department was unaware that 2015 data was uploaded to the EPA STORET website. For the 2016 assessment cycle, the EPA STORET website was queried and all available data downloaded in October 2014. Any data uploaded to the EPA STORET website after this time was not available for the 2016 assessment. No changes were made to the proposed 2016 303(d) List as a result of these comments.

Although many of the Springfield area waters will remain on the impaired waters list, current and future efforts by the city will help inform the prioritization of these waters for future watershed restoration efforts. Where long-term strategies exist for the pollutants of concern, the department has flexibility to delay Total Maximum Daily Load (TMDL) development in lieu of other administrative measures, such as Category 5-Alt, on the state's integrated report. Upon approval of the 2016 303(d) list by the commission, the

department will begin prioritization of impaired waters for future watershed restoration efforts.

The department appreciates the efforts of the City of Springfield toward developing comprehensive, long-term strategies for addressing water quality concerns as part of their Integrated Plan for the Environment. The city's efforts to address storm water quantity and quality through infrastructure improvements, best management practices and citizen education are positive steps toward management of storm water and the pollutants it *carries. Implementation of the city's plan indicates strong, positive commitment on the part of* the city toward addressing short and long term storm water issues. The department looks forward to working collaboratively with the city toward betterment of water quality in southwest Missouri.

EPA Region 7 comments

Barker Creek Tributary (WBID 4083)

EPA provided a comment stating this water body is proposed to be newly listed for impairment due to an excursion of the EPA-approved Missouri water quality criterion for dissolved oxygen. In review of the state supplied assessment spreadsheet, it was noted that the assessment also recommended impairment by chloride plus sulfate and pH. However, the draft list does not include those two impairments.

Department Response

The Barker Creek Tributary was originally placed in Category 5 due to a violation of the general criteria during the 1998 listing cycle. In 2004, the water body was moved from Category 5 to Category 4A due to the approval of a TMDL for pH and sulfate that addressed the pollutant impairment. This water body will be removed from the proposed 2016 list and reinstated into Category 4A. A comment has been added to the Barker Creek Tributary assessment worksheet and the department's assessment database.

Bee Fork (WBID 2760)

EPA commented that this water body is proposed to be listed for contaminated sediments (lead). This water body was previously listed for lead in water and the supplied assessment spreadsheet also identifies lead in water, not sediment.

Department Response

The department appreciates the comment and EPA bringing this oversight to the department's attention. The pollutant for Bee Fork was inadvertently listed as impaired for lead in sediment, when the correct Category 5 listing should be lead in water. The pollutant matrix listing has been corrected on the proposed 2016 303(d) List.

Blackberry Creek (WBID 3184)

EPA stated this water body is proposed for listing due to a total dissolved solids impairment. It was previously listed for an excursion of the chloride plus sulfate criterion. The EPA-approved Missouri Water Quality Standards do not have a criterion for total dissolved solids but do for chloride plus sulfate. Under section 303(d), a state's waters are assessed against the state's EPA-approved water quality standards. In this case a listing for total dissolved solids could be an assessment of the state's narrative criteria, however, the state must still assess against the criterion of chloride plus sulfate. In its action on the 2014 Missouri Section 303(d) List, the EPA added this water body to the list for chloride plus sulfate.

Department Response

The department appreciates the comment and will correct the pollutant listing for Blackberry Creek. The chloride plus sulfate pollutant is not available as a dropdown option within the electronic reporting system, and therefore, total dissolved solids was selected as a place holder for the pollutant until the chloride plus sulfate pollutant can be manually entered into the system as the proper pollutant. The department will update the pollutant listing for Blackberry Creek to chloride plus sulfate. This correction was missed during the 2016 listing cycle, and was revised on the proposed 2016 303(d) List.

Brush Creek (WBID 1371)

EPA stated this water body is proposed to continue to be listed for dissolved oxygen. For the 2016 cycle an additional cause of total suspended solids has been added. In a review of the provided assessment spreadsheet it is noted that the assessment does not indicate an impairment for total suspended solids. The sheet explicitly states there are low levels of total suspended solids.

Department Response

The department appreciates the comment and EPA bringing this listing error to the department's attention. This pollutant was approved by EPA to be delisted during the

2012 listing cycle. This information was corrected in the department's database and the water body removed from the proposed 2016 303(d) List.

Brush Creek (WBID 3986, previously 418U of Blue River)

EPA commented that the assessments (sic) sheet has errors. The calculations are not in the same column as the data being assessed. The state did not use the same data that was used by EPA to list this water for PAHs in sediment. New data for this water body available at the KCwaters.org web site (the source was identified to the state during the 2014 listing cycle and, therefore, should be considered readily available) but was not used in the 2016 cycle assessment.

Department Response

The department accessed the data from KCwaters web site and updated the Brush Creek assessment worksheet. Following the department's methodology, the PAHs that exceeded the 150 percent PEC threshold in sediment, and match with the EPA 2014 Category 5 listing, include chrysene, phenanthrene, and pyrene. The department also assessed fluoranthene as exceeding the 150 percent PEC threshold.

Supplemental sediment data was also reviewed from Brushy Creek just across the state line in Kansas. This data indicated the PAHs that also exceeded the 150 percent PEC threshold were Benzo[a]anthracene, and benzo[a]pyrene.

Center Creek (WBID 3203)

EPA commented that this water body is proposed for delisting of lead contaminated sediments due to a change in the state's methodology for assessing potentially toxic sediments. While the geometric mean of all sediment samples now falls below the narrative threshold, all samples collected from mile 1 through 11.6 are greater than the threshold. This indicates that the new methodology results in an overall average of nontoxic sediments, while all samples from the area located within historic mining areas still indicate potential toxicity based on the methodology. As such, the ten mile portion of this assessment unit with toxic sediments greater that the state's narrative threshold is masked and not acknowledged by this proposal.

Department Response

In reviewing the site locations, three of the sites are located upstream of the historical mining areas (e.g. Webb City and Oronogo Mines). Bracketing river miles to assess the upstream and downstream sites separately does cause the lower reach of Center Creek

(approximately 13 miles) to exceed the 150 percent PEC threshold for lead in sediment. The department has revised the assessment worksheet to retain lead in sediment as part of the Category 5 listing and have added this water body/pollutant pair to the proposed 2016 303(d) List.

Flat River Creek (WBID 2168)

EPA commented that this water body is proposed to have the impairment cause of lead in fish tissue added for the 2016 listing cycle. A review of the EPA-approved TMDL for this water body (Big River TMDL, approved 3/24/2010) shows the TMDL targets specifically identified lead in fish tissue. As such, that TMDL applies to this cause and the water body/pollutant combination already has a TMDL. Additionally, the cadmium impairment has been shifted from water to sediment while the assessment spreadsheet indicates that the impairment remains in water and not sediment.

Department Response

The department appreciates the comment and EPA bringing this oversight to the department's attention. The department will reinstate the Category 4A listing for lead in fish tissue for this water body and remove the listing from the proposed 2016 303(d) List. A comment has been added to the assessment worksheet to note the EPA approved TMDL for Flat River.

Joplin Creek (WBID 5006)

EPA commented that this water body is proposed for listing with causes of lead and cadmium. In review of the assessment spreadsheet, no lead impairment is shown. The assessment identifies cadmium and zinc as impairments for this water body. However, there is only one excursion of zinc criteria shown in the sheet. One excursion does not require the state to identify an impairment. The assessment target is typically more than one excursion in three years on average.

Department Response

The department reviewed the assessment worksheet for Joplin Creek, and noted there were no chronic or acute exceedences for dissolved lead, one acute/chronic event for dissolved zinc, and seven chronic exceedences for dissolved cadmium. The assessment worksheet for Joplin Creek has been corrected, and the Category 5 listing for dissolved lead removed from the proposed 2016 303(d) List.

Mississippi River (WBID 1707, 1707.03)

EPA commented that this water body is proposed to continue its listing for E. coli. The water body identification number is not consistent between the 2014 list and the 2016 proposal.

Department Response

The department reviewed the draft 2016 303(d) List and found the error was due to rounding in Microsoft Excel. The Water Body ID (WBID) for the Mississippi River (WBID 1707.03) has been corrected on the draft 2016 303(d) List.

Peruque Creek (WBID 0216)

This water body is proposed for delisting based on a lack of fish kills since 2010. There is no information presented that indicates the fish population have recovered within the water body assessment unit. As such, a delisting may be premature if the fish community is absent. Time itself is not considered "good cause" for delisting an assessment unit.

Department Response

The department contacted the Missouri Department of Conservation to determine if any fish community data was available to support a delisting decision. It was communicated that no fish community studies have been completed within this stream reach, however, the fish kills in 2010 were most likely due to habitat and hydrologic alterations. Therefore, the department believes it would be appropriate to move this water body to the 4C category as being impaired by pollution and not a pollutant.

Turkey Creek (WBID 3217)

EPA commented that the department has proposed delisting this water body for lead in sediment. EPA stated the portion of the assessment unit between Hwy 66 and Hwy 249 are consistently above the target for listing with one exception. In addition, contaminated sediments using the new averaging methodology continue for cadmium and zinc. These multiple lines of evidence suggest continued impairment of this assessment unit. The department's proposal to delist this water body pollutant combination was originally disapproved by EPA during Missouri's 2014 listing cycle but was retained on the list by the EPA.

Department Response

The department reviewed the assessment worksheet for Turkey Creek. It was noted that sediment data collected in 1976 was retained in the dataset during the assessment cycle. This data is important for historical reasons, however, it may not be applicable to more recent site conditions. The historical data was placed within a separate data table on the assessment worksheet. In addition, the department reassessed the water body to bracket sites upstream of Hwy 66 separately from sites located between Hwy 66 and Hwy 43. It is important to note, the revised assessment does not indicate that lead exceeded 150 percent of the PEC threshold between Hwy 66 and Hwy 43. In addition, the use of the geometric mean calculation is consistent with how the PEC thresholds were developed. As a result of these analyses, the department will retain the request for lead in sediment to be delisted for this water body. No changes were made to the proposed 2016 303(d) List as a result of this comment.

Willow Branch (WBID 3280)

This water body is proposed for delisting of the causes of cadmium and lead contaminated sediments based on a new listing methodology. The listing is retained for zinc contaminated sediments. Similar to Turkey Creek (see above) this water body exhibits sediment concentrations of cadmium and lead in portions of the assessment unit that consistently exceed the concentration targets for listing. By taking the geometric mean of all samples this condition is masked.

Department Response

As previously mentioned, the use of the geometric mean for determining sediment pollutant concentrations is consistent with how the PEC thresholds were developed. In reviewing the assessment worksheet, the department noted an error in the 2014 site code and site description. This information has been corrected to reflect where the sediment sample was actually collected. The correction did not change the department's listing decision for this water body. As of 2014, the department has scheduled this water body for follow-up sediment monitoring.

Wilsons Creek (WBID 2375)

The data presented for delisting of PAH contaminated sediments in this water body do not agree with the data collected by EPA. It seems there have been mix ups in the location of some of the samples as data is attributed to sites on dates where no samples

were collected at those sites. If the state would like, EPA could resupply the original data for reassessment.

Department Response

The department reviewed the data provided by EPA and noted the original data did not download correctly from the EPA STORET. The assessment worksheet for Wilsons Creek was revised with the correct information and reassessed. Benzo[a]anthracene, chrysene, fluoranthene, phenanthrene, and pyrene exceeded the 150 percent threshold for PECs. These pollutants were in concentrations between 15 to 61 percent greater than the 150 percent PEC thresholds. Therefore, this water body will be retained as a Category 5 listing for these pollutants on the proposed 2016 303(d) List.

Missouri Department of Conservation's (MDC) comment

MDC recommended information provided on supporting 303(d) fish tissue assessment worksheets that referenced the "McKee, 2002 (Sport-Caught Fish Consumption in Missouri – 2002 Mail Survey)" citation be removed because the report cited was a draft report. The final report is in final preparations and the cited information contained on the 303(d) assessment worksheets will not appear in the final report.

Department Response

The department appreciates the comment. Since this citation was included as supplemental information and did not change the assessment determinations, the citation was removed from the fish tissue assessment worksheets.